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# AN EVALUATION OF THE AVAILABILITY AND APPLICATION OF MICROCOMPUTER SOFTWARE PROGRAMS FOR USE IN AIR FORCE GROUND TRANSPORTATION SQUADRONS

THESIS

JOHN W. STEIN
FIRST LIEUTENANT, USAF

AFIT/GLM/LSM/88S-69

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# AN EVALUATION OF THE AVAILABILITY AND APPLICATION OF MICROCOMPUTER SOFTWARE PROGRAMS FOR USE IN AIR FORCE GROUND TRANSPORTATION SQUADRONS

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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September 1988

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## Preface

The objectives of this research effort are to determine the current status of the management of End-User-Computing (EUC) as applicable to Air Force Vehicle Operations and Vehicle Maintenance organizations. In so doing, it will also be determined how the management of EUC is being conducted throughout the Air Force as a whole. This study also identifies factors which have contributed to the weaknesses of managing EUC, and proposes a method of bringing about changes in EUC management that could result in a more effective and productive EUC management program.

This thesis would not have been possible without the patience and help of many other people. Although not all will be able to be mentioned, a few significant acknowledgements will be made. I owe a great deal of gratitude for the ultimate completion of this effort to the patient guidance and direction afforded me by my thesis advisor, Dr. James R. Stock. Without his enduring patience and advice, the quality of this thesis wold not have been the same. I would also like to thank Major Robert Trempe, who served as my faculty coordinator and also as my alter ego. He encouraged me to keep digging when I thought I'd dug deep enough, and in so doing, helped me to make new discoveries that I may have otherwise overlooked. In particular, I wish to thank my best friend Katy, who happens to also be my lovely wife,

for her understanding, encouragement and affection throughout this most enduring experience. The same can be said for my three wonderful children, Chris, Adam, and Emily - the true wealth of my life. Their presence kept me pushing when I might have otherwise relented.

John W. Stein

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## Abstract

The conditions and events which served to highlight the fact that End-User Computing (EUC) had been ignored in the past and is being poorly managed in the present are discussed. Mind-sets and faulty prioritizations which may prevent the successful implementation of software management are also discussed. The significance of implementing a Transportation Software Catalog to enhance the Air Force's computer resources, its role as a significant contribution to effectively managing ground transportation operations, and its potential for improved savings are addressed as well. The timing of EUC management emphasis, current guidance and direction, recommended methods of implementation, and current examples of off-the-shelf transportation software available from both military and civilian sources have also been investigated.

# AN EVALUATION OF THE AVAILABILITY AND APPLICATION OF COMPUTER SOFTWARE PROGRAMS TO AIR FORCE GROUND TRANSPORTATION UNITS

## I. Introduction

### Background

According to a Functional Management Inspection conducted between 27 January and 31 December 1986, the lack of Air Force standardized vehicle management microcomputer software programs along with inadequate training resulted in the production of obsolete vehicle data analysis. The cause was identified to be the routine use of antiquated manual data collection and analysis methods. (TIG, 1986:2)

This inspection further stated that there existed no single agency to act as a clearing house for microcomputer software programs being developed and used in Air Force ground transportation squadrons. (TIG, 1986:2) It stated that software programs were being developed by personnel at all levels on an individual basis with minimal programming experience. It was suggested that several of these programs were comprehensive enough to be used on an Air Force wide basis, but that no agency existed which could test, refine, and sanction the multitude of programs that were then currently available. (TIG, 1986:11)

Whereas all the most recent progress in the use of microcomputers was believed to have been based upon the

individual expertise of any given individual at each base, this inspection report recommended the identification of a single office of primary responsibility for the development and dissemination of functional area programs. (TIG, 1986:11) The conclusion that is drawn from this report is that little attention is being given to the justification of user-unique software development, and that development processes are not being well managed by the Air Force.

Research suggests that end-user computing (EUC) is growing at a rate of approximately 50%-90% per year as measured by either actual allocation of computer hardware power or external time-sharing budgets. (Rockart and Flannery, 1983:777) With internal software development, the development process should be managed. Internal program development often results in duplication; that is, there exists a tendency to start from the beginning with each new program developed.

Oftentimes, if a software application program was not developed by or for a specific user, already existing software which might have proven sufficient in meeting the identified need may be overlooked or not adequately investigated. Because these 'not-invented-here' complexes exist, much time and energy is wasted in developing application programs to perform tasks for which perfectly good software have already been developed. (Lucas, 1982:272)

In addition, in order to take full advantage of microcomputer technology, a transportation manager must learn to participate not only in the development process, but also in the application of new technology. In order to do so, managers should acquire a thorough knowledge of, and familiarity with, computer technology and the integration of the computer into their regular regimen of activities.

One approach to resolving these problems would be the development of a cataloging system for selected transportation-related microcomputer software programs. This library would be derived from a critical evaluation of many of the currently available military and civilian software programs with transportation related applications. This library could then be used as an aid in the integration of the computer into transportation planning, organizing, and controlling activities.

A survey of civilian industry could be conducted to ascertain what types of application packages are currently being employed in the civilian sector. Those programs with a potential orientation towards military applications could then be selected for inclusion in the software library.

An attempt might then be made to acquire these programs for the military. These programs could prove useful in a variety of ways. First, they could be used right off the shelf, without any changes. They might also be used with slight modifications to adjust them to

certain peculiarities of the military. And finally, they might be used as a basis for development of a needed Air Force program, thus saving money and reducing development time by eliminating the potential for 'reinventing the wheel.'

After a thorough investigation of available transportation related software programs has been conducted, the assembled catalog might also be used to serve as a framework for the development of an on-line bulletin board consisting of a more complete database of a large number of selected software programs. This bulletin board could then be used as a guide for aiding military transportation personnel in the selection of appropriate software programs to meet their needs. This bulletin board could also be used to serve as a communication network for military transporters worldwide.

A properly designed categorization of the most current and applicable software programs would serve several purposes. First, it would relieve the Transportation Manager of the burdensome task of seeking out those programs that would be most beneficial to the particular task at hand.

Second, it would relieve personnel of performing repetitive tasks such as creating reports and summarizing data analyses. Often such tasks are performed manually simply because personnel are unaware of the availability of software programs that will perform these tasks automatically.

Third, it could also prove to be an invaluable aid in the establishment of enhanced management performance criteria by pointing the manager to those programs which would assist in creating schedules, developing effective training programs, and analyzing inspections.

Fourth, by opening the door to the plethora of software available, a routinization of control functions could be established which would permit managers to allocate more time to planning or increasing efforts to enhance customer service standards.

Oftentimes, a manager can get so bogged down running the day to day affairs of an operation that ideas for improvement fall by the wayside. By computerizing many of these functions, more time could be made available for making desired improvements.

## Overview of the Problem

It has been the experience of this researcher, and has been affirmed by James P. Hudson, Chief of Plans and Requirements Division for Aeronautical Systems Division at WPAFB, that although vast quantities of computer hardware have been amassed, in many cases, critical software needs have often not been met.

In 1983, Zenith Data Systems won the first Air Force/ Navy contract for 6,000 microcomputers. In early 1986, another contract was awarded for up to 60,000 more. (Mace, 1985:14) Although there exists a proliferation of

hardware, there seems to be a general lack of application software available for use by Air Force transportation managers. Without the appropriate *software*, an *extensive* network of computer hardware can be limited in its effectiveness.

Many of the microcomputers on the market today can be configured to exceed the capabilities of 1960's mainframes. According to Robert Quinn, an Associate at the consulting firm Temple, Barker, and Sloane at the time, 'In the next few years, microcomputers will become bigger, faster, and more efficient - even catching up with today's mainframes. Today's microcomputer software has 80 to 90 percent of the capability that mainframes had five years ago. Judging by the new state-of-the-art applications that are continually being introduced, micro capacity soon will surpass the older mainframes' by up to 120 percent.' (Callas, 1984:87) Although impressive, present usage does not always take full advantage of the capabilities of modern computers. Only when users accept the microcomputer as relevant to their needs and integrate it into their routine via appropriate software programs can it be truly labeled a *success*.

It seems that some organizations are well ahead of others in their utilization of available microcomputer technology. The limiting factor being experienced today in the operational world is the knowledge of available software applicable to the variety of tasks pertaining to the specific mission of an organizational unit.

'Because 'user-friendly' microcomputer software now is available, traffic managers do not have to be computer programmers to design applications for their own operations.' (Callas, 1984:87) The development of application software requires a broad knowledge of computer programming, while most personnel are limited only to a technical orientation towards their own career specialty. Thus, in all likelihood, there are probably only a limited number of people possessing the skills necessary to both develop and implement user-unique software application programs.

However, a new generation of users have emerged who understand programming procedures and view the computer as a means of facilitating decision-making and improving productivity. The ability to adapt computers and communication technology to better manage information for decision making led a list of factors considered most important by logistics executives in a 1986 Career Patterns Study conducted for the Council of Logistics Management. (LaLonde and Mason, 1986:8) As with many developing technologies, the key to its success lies with the people who work daily with that technology.

The management of any logistics system requires effective planning and control of each activity, and the collective set of activities. Computers are an important tool in this management process since the field of logistics is inherently transaction intensive. Computers facilitate the collection and transformation of data into useful

information and the analysis of various decision options in a timely and accurate manner. (Chow, 1984:471) Therefore, a database of pertinent software programs would provide a valuable service for many users.

However, according to Maj Jordan and Capt Hoeft, action officers at HQ/LET, there is not currently available a database or centralized cataloging system which lists computer programs pertinent to the specific management problems of a ground transportation unit. (Jordan, 1988) Although this idea has been proposed in the past and attempts have been made to implement it, the complete idea has never actually been fully carried out. Problems have typically arisen in the areas of coordination and cooperation efforts.

In addition, many fear that divulging such information as to which programs are actually being employed would invoke the opportunity for someone to set up a system of control that would inhibit creativity at the user level. Consequently, each unit has for the most part been left to its own devices to develop or uncover computer software programs pertinent to the specific needs of their mission.

For instance, in the Fleet Analysis section of Fleet Management, there are only a finite number of tasks to be accomplished (see Appendix 1). However, there are a multitude of programs being used to accomplish those tasks (as well as some bases which, for the lack of computer skills or

knowledge of available programs, are not using the computer at all).

Fleet managers using the microcomputer programs now available are able to make better decisions and solve problems much more quickly, resulting in operational improvements and lower costs. (Paterson, 1983:32) However, the economics of microcomputers and available software make it possible to have microcomputers throughout an organization. They possess enormous data storage capacity and can be configured to provide on-line data processing to all sections. Valuable information can then be made available for immediate review, rather than having to wait for weekly or monthly reports to arrive.

Thus, the potential exists for a substantial savings of dollars through the centralized monitoring of existing and yet to be developed application software programs for use by Air Force ground transportation units. Savings of 5 to 20 percent could easily be achieved through establishment of cost effective programs for record keeping, maintenance, vehicle utilization, parts availability, labor productivity, fuel usage, driver control and tire expenditures. (Paterson, 1983:32) Standardized software using authorized programming languages could be developed with enough versatility to accomodate a variety of functions within a transportation unit.

It is a matter of public record that for years the Congress and the Secretary of Defense have repeatedly directed DOD agencies to avoid or eliminate overlapping and duplicating functions whenever and wherever possible in order to promote economy and efficiency of logistics operations. (GAO, 1980:13)

In addition, as outlined in AFR 700-9, Vol I, para 1-3, one of the purposes of the Air Force Information Systems Standardization Program (ISSP) is to set software standards for programming languages and the inventory of software. Two other stated objectives of this program are to minimize the proliferation of different types of software being used within the Air Force, and to maximize operational effectiveness.

The cataloging system proposed by this thesis would lend assistance in meeting all of these goals through the accomplishment of the following objectives:

1. reduce the multitude of programs being used to perform the same function;
2. reduce the time and effort being spent to create an application package when such a package already exists; and
3. promote more efficient use of the computer by those lacking the skills to develop an application package.

As the momentum towards increased automation expands, and end-user programming utilizes more of an organization's computing resource, the need for a centralized point of control becomes increasingly evident. (Rockart and Flannery,

1983:776) With proper management of the development process, duplication of software, which can prove quite expensive in terms of the initial investment of time and money, could essentially be eliminated.

Furthermore, by using standardized software, training costs could also be reduced and implementation of application programs could take place much earlier than if attempting to develop the required application program every time it was needed.

In addition, a centralized agency could perform the function of maintaining the continuous upkeep that would be required to keep current the various programs thus created. It could also perform housekeeping functions such as data management, privacy, security, and maintaining uptime, while the users would take responsibility for developing and operating the programs.

End-user development of applications has many advantages, but there are some disadvantages as well. Although end-users are becoming more aggressive and more knowledgable, many quality assurance procedures are often being omitted. These include testing, documentation, validation of data, operating control, and backup and recovery procedures. (Davis and Olson, 1985:432)

An organization should have policies that encourage end-user development but that also result in adequate quality assurance. According to research conducted by John

Rockart, director of the Center for Information Systems Research at the Sloan School of Management, on 17 major corporations, despite the rapid growth in end-user computing in the organizations studied, there was a noticeable lack of organizational strategies for promoting, managing, or controlling it. It was discovered that little research attention had been given to identifying who the users were, what they were doing, what their needs were, and most significantly, how to control this growing phenomenon. Since it was recognized that end-user computing is difficult to control, policies for end-user computing were largely ignored. (Rockart and Flannery, 1983:776)

Whereas the Air Force encourages the use of modern software development techniques when possible to improve productivity, usability, reusability, maintainability, reliability, and portability (AFR 700-9, Vol I, 1985:5), it was presumed from this research that the Air Force might also be given to not adequately exploring all available avenues for controlling EUC.

Additionally, it was presumed that the Air Force had not given much attention to the development of an end-user strategy. Confirmation of these presumptions was made following interviews conducted with key personnel at several resource management centers. (Gilbert, Jordan, and Hudson, 1988)

Specific Problem

The lack of a centralized agency for the control, and dissemination of computer software programs for use by ground transportation squadrons is creating the potential for duplication of effort by the variety of transportation units throughout the Air Force. This duplication of effort is costly in terms of time, manpower, and money. As a result, instead of creating new ideas, time is frequently being spent redeveloping old ideas while other units with less skilled personnel are left wanting for lack of appropriate software to meet their needs.

The capabilities of modern computers continue to expand at an ever increasing rate. Advances in processing speed, memory storage capability, and time sharing provide the modern manager with an increasingly powerful tool, one which will help to improve the power and productivity of the individual manager.

The availability of microcomputers make it easier to do analysis, communicate, and make decisions. Computerizing an operation can increase effectiveness by saving increasingly valuable time, manpower, and money.

Computers will also assist managers in responding more rapidly to changes in critical environmental factors such as the imposition of budgetary constraints or changes in regulatory policies, and in coming closer to achieving organizational goals in less time.

'If successful, microcomputers may have their greatest impact on the capacity and readiness of transportation professionals to be more exploratory, more responsive, and more systematic in their approaches to issues about what services to provide as well as in managing and planning for the delivery of those services.' (Manheim, 1984:300) Present and future advances in computer usage depend not only on the development of new computer capabilities but also upon the Air Force's ability to make effective use of those capabilities.

Since the efficient utilization of the computer depends largely upon the software being used, many special software programs have been designed to help make the manager's job easier, less time consuming, and less subject to error. 'There are applications employing general purpose software packages (e.g., spreadsheets, database systems) as well as complex specialty software which rival mainframe applications.' (Walters, 1984:294)

Information, like capital, labor, and materials is an organizational resource which requires management attention. There appears to exist, therefore, an urgent need for some type of management control system which will:

1. manage and monitor computer software programs for use by ground transportation units;
2. substantially reduce present duplication of effort in creating computer software programs; and

3. eliminate independent, uncoordinated computer software development within individual functional areas.

If one believes that, 1) end-user computing will continue to grow in the coming years, 2) end-user oriented information databases are increasingly becoming an integral part of the working environment, and 3) rapid change in the tools and techniques available in this area require guidance - then the lack of a strategy and a clear long-range plan in this area is a serious mistake. (Rockart and Flannery, 1983:782)

## Objectives of the Study

In order to receive a satisfactory return on the large and growing investment in its computer assets, an organization should ensure that its software resources are well defined and documented, well organized and controlled, shareable, and relevant to the decisions that need to be made. (Loomis, 1987:7) This project is designed to develop a logical structure which can later be used to create a database of available and applicable transportation related software programs; one that categorizes and overviews each piece of software by function and characteristics. Indicated within this database would be several data fields, such as those depicted in figure 1, that would cover a multitude of specific areas of interest.

The Applicable Functional Area would be that area of a transportation unit where this program would be found to

# POSSIBLE DATA FIELDS TO BE INCLUDED IN PROPOSED DATABASE

Major Category:

Applicable Functional Area:

Title of Program:
Date of Program:
Description:

Language:

Hardware Environment:

Source of Program:

Point of Contact:

Availability:

Documentation Available:

**FIGURE 1**

be most beneficial. Included within the Description section would be such things as the cost, date of most current version, and level of usability. Hardware environment would indicate what type of computer and operating system the program is intended to be used with. The source of the program would indicate where the program originated and the Point of Contact would indicate where one might find a copy of the program or have questions answered.

Each program included as a data element in this database would then be considered to be an available data resource for use by ground transportation managers throughout the Air Force. A data element is defined as a unit of data which is not decomposable into other individually named units. Data resource is defined as data which has been processed into information which has inherent value.

Information is of value to a decision-maker only as it aids in the decision-making process. By having available a ready access to pertinent application packages, a transportation manager could then select whatever software program that would prove most valuable in its affect on the decision or problem at hand.

Investigative Questions

In order to develop the criteria used for the selection of appropriate software programs, and outline the means for obtaining this data, the following investigative questions were posed:

1. What are the functional requirements of an Air Force ground transportation unit?
   Source: AFR 77-310, Vol I (Vehicle Operations, Acquisition, Management, and Use of Motor Vehicles) and Vol II (Vehicle Maintenance Management)

2. What commercial or military software programs are available to meet the functional requirements stated in the previous question?
   Source: Input from Transportation Systems Integration Panel (TSIP), MAJCOM Small Computer Technical Centers (SCTC), and commercially available software catalogs

3. What criteria should be used in selecting software programs to be included in the proposed catalog?
   Source: TSIP and results of Literature Review

4. What current guidance or direction has been given for purchasing and/or developing computer software programs acceptable to the Air Force?
   Source: AFR 700-9, Vol I, Information Systems Standardization Program, and AFR 700-26, Acquisition and Management of Small Computers

5. Are there centralized organizations within the Air Force keeping track of software being used and developed by subordinate units? If so, what cataloging attributes are currently being employed?
   Source: AFR 700-26, MAJCOM SCTC Software Catalogs, and TSIP

A review of the answers to these questions will be covered in Chapter 3, Methodology.

## Limitations of the Study

Due to the magnitude of the logistics field and more specifically, the magnitude of operations even within the field of transportation, this study will focus exclusively on functional areas within motor vehicle management; this is to include Vehicle Maintenance Management and Vehicle Operations Management.

Although the acceleration being seen in the use of microcomputer technology has prompted the development of a variety of computer software programs in areas such as air transportation and traffic management as well, it is not within the scope of this thesis to address these areas. The focus of this thesis will be limited to investigating software programs pertinent specifically to the management of functional areas within Vehicle Operations and Vehicle Maintenance branches.

Key areas to be highlighted will include, but not be limited to, a discussion of microcomputer applications, a review of sources and availability of programs, and a review of the various uses for application programs within the areas of Vehicle Operations and Vehicle Maintenance.

Only software programs capable of being used on a microcomputer will be considered for analysis. No software intended for use on a miniframe or mainframe computer will receive attention.

Also to be limited will be the creation of the database itself. As the ultimate users of a database system should help define the data requirements as well as help design the logical structure of the database to support their information requirements (Loomis, 1987:16), a database model will be proposed, but will probably need to be refined at a later time by the selected data administrator and the ultimate users of the database.

A specific data administrator will not be identified. However, the selection of one with an intimate working knowledge of the functional areas within a ground transportation unit would of course be highly recommended.

Assumptions

The field of logistics has seen an explosion in the use of microcomputers in the past several years. Available information suggests that the microcomputer represents a potentially significant component of an organization's information system. (Langley, 1987:14)

Microcomputers provide a means for standardizing operational information systems for management control, strategic management, decision support systems, office automation, and knowledge work support systems. As such, microcomputers should be considered as a vital strategic element of an organization's operations management.

Currently, transportation squadrons have no computer literacy requirements for their personnel, and as the development of software is quite expensive, some sort of predeveloped application program is normally required to derive the greatest benefit from the microcomputer. Fortunately however, the increase in the number of microcomputers has prompted a parallel rise in the quantity and quality of available software. This has resulted in lower overall costs for software and enhanced opportunities for standardization between geographically separated units.

As the Air Force only intends to purchase mature, proven software, debugging and testing costs could subsequently be reduced through the cataloging of available transportation software. In addition, the potential exists for reducing training requirements when personnel are reassigned within or between organizations. It can be expected that standardizing software will also encourage continued compatibility between the various hardware components throughout Air Force transportation squadrons.

Summary

Compact, low cost microcomputers, along with their innovative and rapidly increasing software application packages, represent a major transformation in computer technology. The microcomputer provides a valuable adjunct to mainframe and minicomputers. The effective use of computer power has proven to be an important source of individual and organizational productivity. They support a movement toward greater flexibility and responsiveness.

However, the proper software must be made readily available to computer novices and experts alike in order to attain maximum results. It is time that the Air Force in general, and Transportation in particular, begin taking stock of its software resources to improve the capabilities of their current hardware assets. Some sort of software cataloging system specific to the differing needs of each organization would appear to be a much needed requirement.

# II. Literature Review

## Philosophy

One of the purposes of this thesis is to identify computer software programs for use by Air Force ground transportation personnel in the performance of their duties. However, more deeply rooted in this thesis is the proposal that it is time to begin the shift from simply managing hardware resources to a more detailed management of the software resources being used by Air Force personnel.

The development of computer technology presently in use in the Air Force has passed through several important stages of growth over the past several years. The importance of managing this growth process was commented on in Chapter 1 and will be looked at in greater detail in this chapter. Also included in this chapter is a review of the development of the conceptual schema selected for the proposed software catalog.

The problems pertaining to the growth of computer technology in an organization expand over a broad horizon and can be quite complicated. These problems entail questions involving hardware setup and interfacing, and the selection and development of appropriate software.

Other problems to be considered in the expansion of computer technology (but not to be included within the

parameters of this thesis) involve the management of the growth of advanced data processing systems.

The review of literature pertaining to the use of microcomputers in the field of transportation was primarily designed to examine the various functional areas where microcomputers have proven themselves to be effective management tools. Although the application of the microcomputer as a management tool in a variety of transportation activities (such as those involved in fleet management or vehicle maintenance) is relatively new, it was quickly discovered that there was no shortage of written material available. The subject of microcomputers and the impact they have had on the entire field of logistics has been explored rather extensively. Also covered quite extensively were current trends relating to the use of microcomputers in the various logistics fields and an overview and background of the brief lifespan of the microcomputer industry.

Compact, low cost computers along with their innovative and rapidly increasing software application packages, represent a major transformation in computer technology. Simkowitz and Manheim in their article 'Microcomputers and Transportation Team Up: What's Ahead?', stated: 'In each era of computer technology, we have evolved a style of transportation practice (planning, management, analysis) consistent with the available technology. The microcomputer era is a period of truly personal computational support for

the professional - the era of 'the professional's personal computer'.' (Simkowitz and Manheim, 1983:9) The effective use of computer power has proven to be an important source of individual and organizational productivity. They support a movement toward greater flexibility and responsiveness of management.

The experience of a number of logistics executives indicates that managers, planners, and operating personnel alike have been depending increasingly on the availability of responsive data processing and information management technologies. (Langley, 1987:3) As a result, the entire field of logistics is making greater use of such capabilities to assist in management functions such as planning, implementation, and control. In addition to the fact that the computer has already been recognized as a useful tool and a productive resource, there is a significant interest in the use of microcomputer technology to assist decision-makers and others in the accomplishment of their various responsibilities. (Langley, 1987:3)

Guidance and Direction

The Nolan Stage Model, first introduced in 1974 (Gibson and Nolan, 1974) provides a framework useful for identifying issues and evaluating and controlling the growth of electronic data processing (EDP). Later updated in 1979, Nolan identified six distinct stages in the growth of all

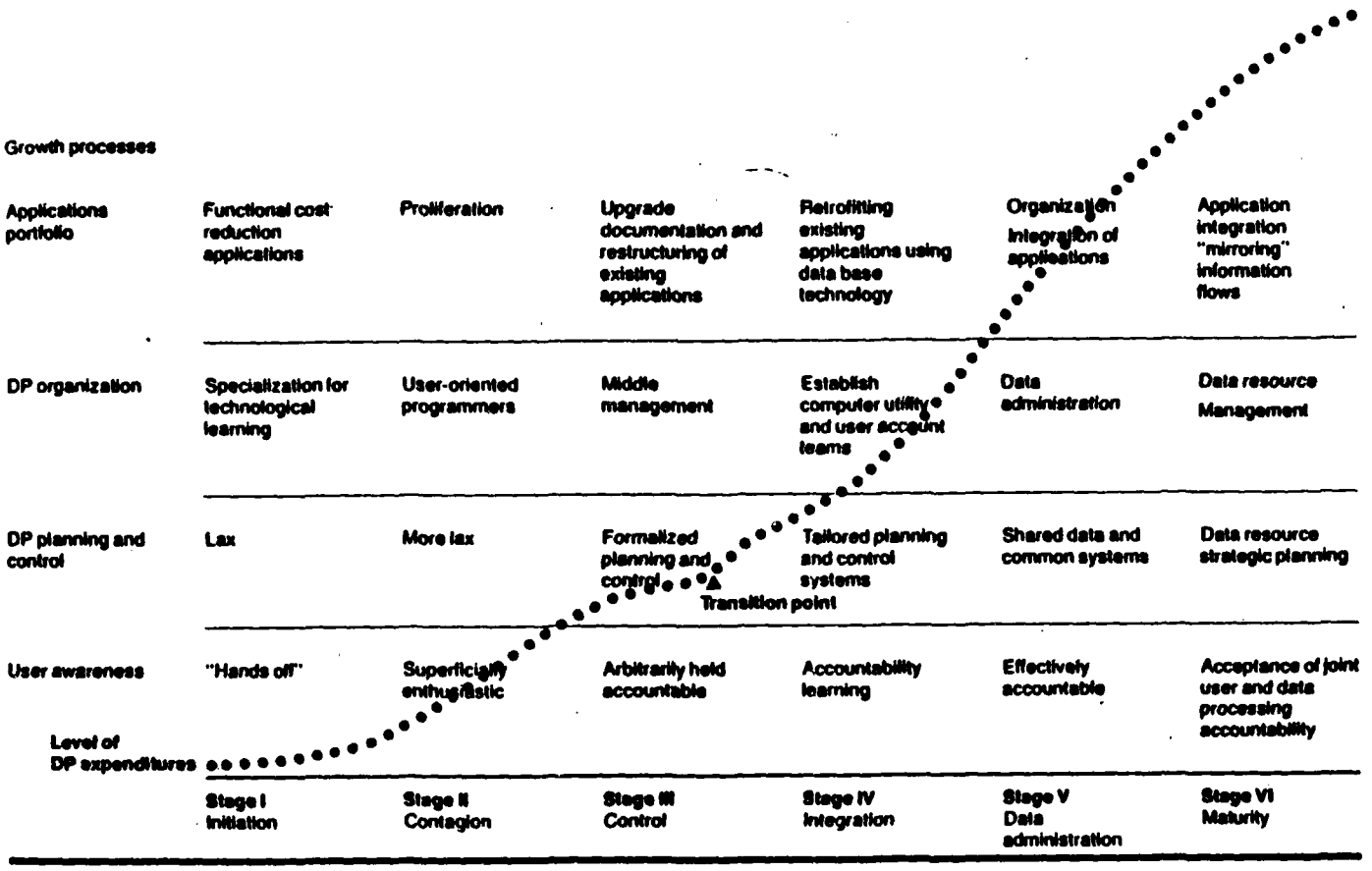
EDP functions; each with its distinctive applications, its rewards, and its inherent managerial problems.

Associated with each stage is a distinctive, informal organizational process. It was theorized that each of these plays an important role in giving rise to the issues that need to be resolved if that stage is to be passed without a crisis, and if the growth of the resource is to be managed to yield the maximum benefit possible. This sequence of stages serves as a useful framework for putting the problems of the computing resource in perspective and helping management understand the problems it will face as it moves forward. They are readily adapted here to EDP growth within the context of military ground transportation operations. The following paragraphs will develop in a general and then in a more specific fashion some very basic concepts about the Nolan Stage Model.

The six stages of growth proposed by Nolan, from the inception of the computer into the organization to the mature management of data resources, are depicted in Figure 2. (Nolan, 1979:117) Through mid-stage 3, EDP management is concerned primarily with the management of the computer. Such has been the case thus far seen within the Air Force environment within the last several years.

At some point in stage 3, there is a transition to the management of data resources. This transition involves not only a restructuring of the EDP organization, but also

# Stages of Data Processing Growth




**SOURCE: Nolan, 1979:117**

**FIGURE 2**

involves installing new management techniques. This transition stage is also typically associated with the introduction of database technology. (Nolan, 1979:116-117) Within the Air Force, this is now being experienced with such things as the introduction of On-Line VIMS which allows direct access by transportation personnel to databases once controlled exclusively by mainframe computer systems typically located within the Supply organization.

The premise upon which this thesis is based is that the United States Air Force (with regard to its ground transportation operations) is presently experiencing the transitional phase of EDP growth. As such, it is imperative that a closer look be taken at developing plans and strategies adequate to coordinate a controlled growth pattern for the development of EDP within ground transportation activities.

Modeling

Although Nolan's stage model was intended to be used on a much broader, corporate level application, it can also be successfully applied to a more specific area of application. (Nolan, 1979:122) The following discussion is intended to be directly applicable to the management of EDP growth specifically within the area of ground transportation management.

When top management permits organizational slack in the EDP activities, that is, when sophisticated controls are

notably absent, more resources are committed to EDP than are strictly necessary to get the job done. (Nolan, 1979:117) Greater innovation may result, but costs of operation would be subsequently higher. The balance between control and slack is important in developing appropriate management approaches for each stage of organizational learning. A proper balance between control and slack must be achieved in order to nurture innovation while keeping costs and inefficiencies under control.

During stage 2, the organization encourages innovation and extensive application of the EDP technology by maintaining low control and high slack. While widespread penetration of the technology is achieved by expanding into operational systems, problems are created by inexperienced programmers working without the benefit of effective EDP management control systems. (Nolan, 1979:118) This is what has been observed within transportation squadrons over the last couple of years at base level. Once the hardware had been installed, personnel were allowed a great deal of freedom in the use and development of software application programs. While a combination of low control and high slack makes for an ideal environment to facilitate organizational learning, the seeds are being sown for a subsequent explosion in EDP expenditures. (Nolan, 1979:118)

Stage 3 is characterized by professionalizing the EDP activity to give it more standing within the organization.

(Nolan, 1979:118) During this stage, computer utility and networking reach a point where high-quality services are being reliably provided to users. This stage is also characterized by initial attempts to develop user accountability. When these accomplishments are achieved, a subtle transition into stage 4 takes place.

Without the successful completion of each stage, the inefficiencies of rapid growth will continue to create wave after wave of problems. Organizational learning and movement through the stages are influenced by the external body of knowledge of the management of the EDP function on how to manage current EDP technology, as well as by management's internal body of knowledge. (Nolan, 1979:116)

By all indications, EDP growth within the limited arena of Air Force ground transportation is at the crucial transition point between stages 3 and 4. At this point, the emphasis of management should be shifting from the computer itself to the management of data resources. Applications should begin to be structured around the sharing of data and new planning and control systems should be data-oriented for the benefit of the organization's users. (Nolan, 1979:124)

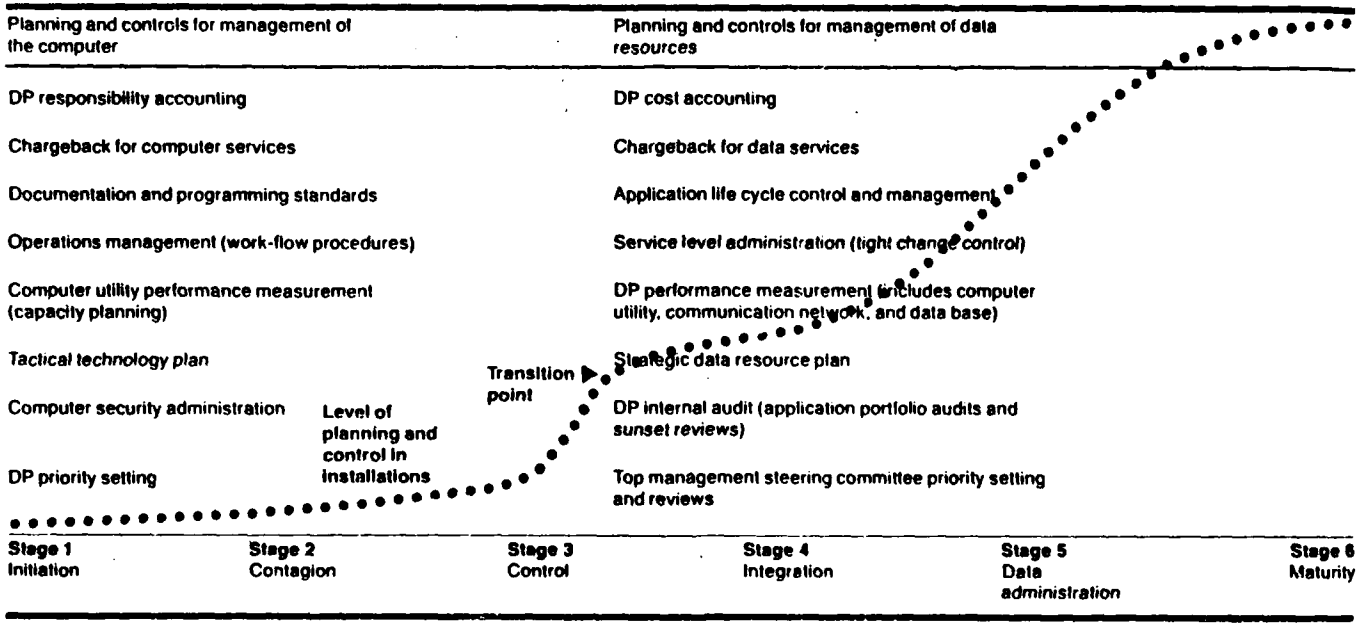
The extent and complexity of corporate activity make it impossible for an organization's computer resources to be 'all things to all users'. Consequently, decisions need to be made as to what the data processing functions of an organization will encompass - its priorities and purposes; when,

where, and whom it will serve; and so forth. (Nolan, 1979: 126) If the EDP management makes these decisions without the benefit of an agreed upon strategy, the decisions reached may be the wrong ones. Figure 3 (Nolan, 1979:120) depicts the typical pattern of starting and developing internal and external control systems. They range from the simple setting of priorities for computer hardware to the more difficult task of accounting for valuable data resources.

Within the military, attempts are being made to institute forms of data control. The Air Force Information Processing Standards for Computers (IPSC) program is concerned with the Air Force role in developing, coordinating, approving, and implementing computer-related standards. (AFR 700-9, Vol I, 1985:12) AFR 700-9, Vol I, para 2-4a and 2-6 directs that information systems managers will develop procedures for reviewing and reporting on the use of software development techniques. However, as evidenced by the experience and research efforts of this researcher, the results of these actions are not being adequately filtered down to those who are actually developing and using user-developed application programs at base level.

More effort is presently needed to implement the strategic plans established and designed to manage software as a valuable data resource. However, first software must be considered as a valuable data resource. Until such time

# Growth and Maturation of Data Processing Planning and Control




**SOURCE: Nolan, 1979:120**

**FIGURE 3**

as a more analytical approach is taken to determine the utility value of the Air Force's computer resources, the Air Force is destined to linger between the control and integration stages or else stagnate in the integration stage.

As the extent to which a data resource is to be managed is entirely dependent upon how much attention is given to this resource, it is considered essential that a formalized system be adopted for analyzing what software resources are currently in use and which areas are lacking in the availability of appropriate software tools.

The most recent budgetary constraints imposed by Congress have made it difficult to properly plan, man, and monitor all that is going on in the field of software technology. A cataloging system such as the one recommended would help to alleviate some of this burden by consolidating the most current information on advances in software development at one central location.

Structural Development

This literature review also attempted to find proposed criteria which could be used or considered in selecting software programs and in developing the logical structure for the proposed database. The literature examined in this review included military and transportation related publications (journals and regulations) as well as

books and magazine articles dealing with the development and cataloging of microcomputer software.

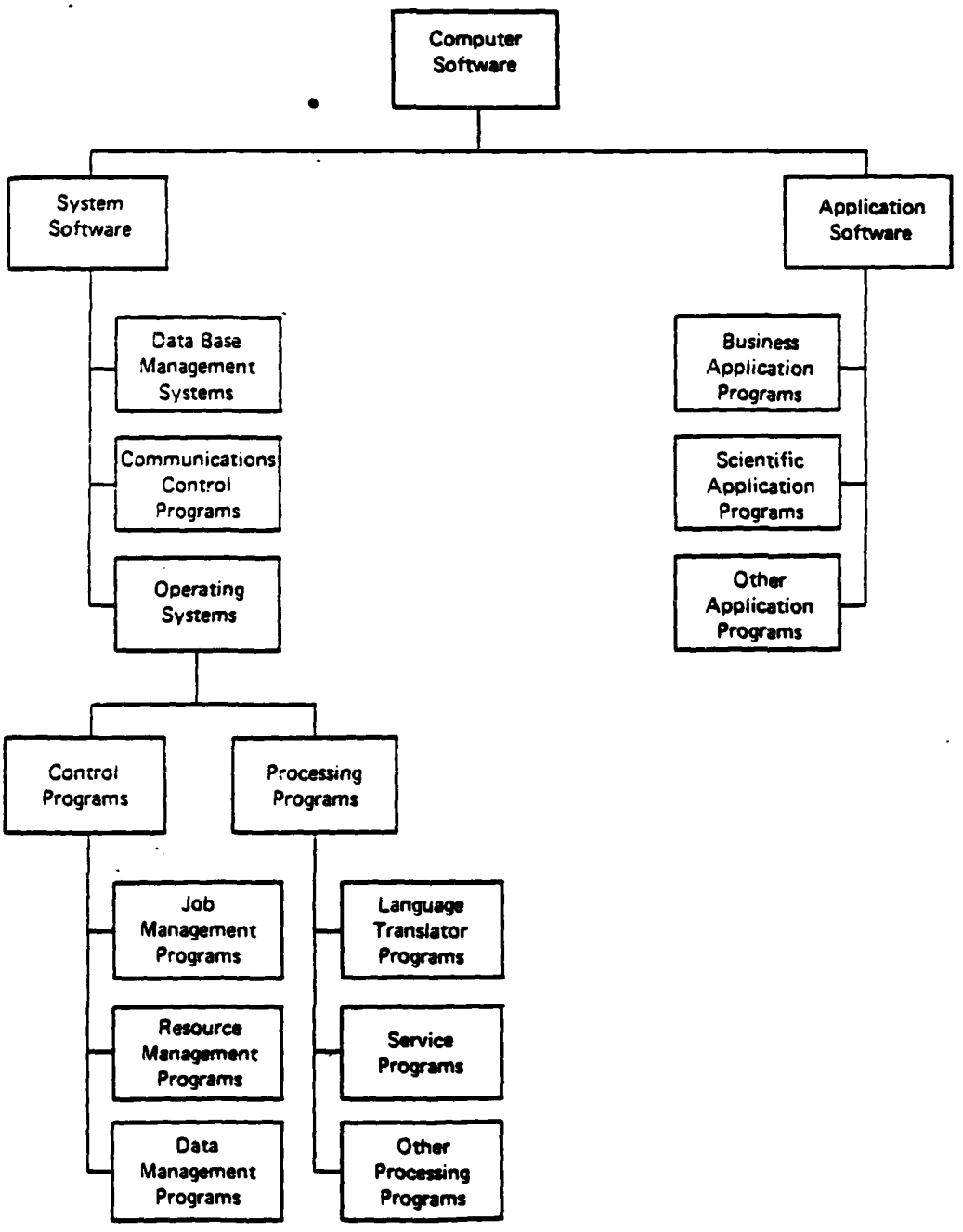
Basically, two types of software operate on microcomputers: operating system software and application software (see Figure 4). Operating system software operates the computer hardware's basic system functions such as providing basic input and output routines, file maintenance procedures, and system controls which assist the execution of application programs. Operating system software normally comes with the hardware rather than being internally developed as is often the case with application software.

Application software generally requires system software for its execution and is intended to accomplish specific user applications. It might consist of general purpose, commercial, or vendor-supplied software programs for word-processing, database management, spreadsheets, or programs specifically developed by users for unique problems. (AFR 700-26, 1986:6)

An application system consists of a set of programs and related manual procedures to accomplish information processing. The cost of developing a large application system can be very high. The main advantage of developing a system in-house is to obtain a unique system designed to fit the specific needs of an organization.

There is a growing trend toward purchasing generalized application packages and using internal development

# TYPES OF COMPUTER SOFTWARE




**SOURCE: O'Brien, 1982**

**FIGURE 4**

procedures to tailor the packages to unique organizational needs. (Davis and Olson, 1985:67)

In addition, a new type of application software has also evolved which integrates a multitude of capabilities. It includes word processing, graphics, spreadsheet capabilities and simple database management systems. It allows for even greater flexibility on the part of managers, allowing them the capability of performing any number of analyses. An example of this type of application software is The Software Group's ENABLE package. It combines all of the capabilities mentioned into one neat package.

As the operating system software is not normally the subject of end-user computing, within the context of this research effort, only the application software will be considered for discussion.

The general schema of a database is an overall conceptual or logical view of the relationships between the data in that database. The schema should be designed to meet the information processing needs of the system's users within the limits of hardware, software and personnel resources.

The first step in determining a conceptual schema was a review of Air Force manuals in order to determine what classification systems were presently being used by the Air Force. According to AFR 700-9, Vol I, para 2-11a(3)(f), the Data Systems Authorization Directory (DSAD) is the official

catalog of software systems authorized for use by Air Force activities.

The DSAD is intended to provide assistance for managers and developers in identifying systems already developed or being developed which could be used to reduce overhead and support costs of system design, development, and maintenance. (AFR 700-9, Vol II, 1985:4) The Air Force DSAD, which is published and maintained by HQ Air Force Communications Command (AFR 700-9, Vol I, 1985:8), supports the objectives of the Federal Software Exchange Program and aids in the submission of software summaries to the General Services Administration for use in the Federal Software Exchange Catalog. (AFR 700-9, Vol II, 1985:2)

Unfortunately, the DSAD does not list individual software packages; rather, it lists computer systems being used. A system comprises an integration of a specific combination of hardware and software. For instance, Dial-A-Log is a system listed in the DSAD. Dial-A-Log consists of a program written in a computer language called L-10 that is run on a DEC-20 miniframe. The combination of the specific software program written to operate Dial-A-Log along with the hardware used to run the program constitutes a system.

As an aside, Dial-A-Log just happens to be an unofficial bulletin board that attempts to list all computer software programs currently being cataloged by the MAJCOM SCTCs. Although a suggestion had been submitted on two

different occasions attempting to make it an officially recognized Air Force bulletin board, thus far the suggestion has not been accepted. The first time it was submitted, it was rejected. At the time of this writing, the second submission had reached as high as HQ Air Staff. The irony is, when asked where or how they obtained most of their software, without fail, every SCTC contacted said that they used the Dial-A-Log bulletin board.

Most of the Air Force regulations dealing with computer usage were written several years ago and were not geared towards the proliferation of software dealing with microcomputers. Instead, they were geared more towards managing the use of miniframe or mainframe computer systems.

What has been set up to deal with the tracking of microcomputer software programs are the MAJCOM SCTCs. They are designed to monitor software programs sanctioned by the Air Force for use on microcomputers. The greater proportion of these programs are user-developed programs. Each SCTC is required to publish a catalog listing all of the software programs being used within their respective commands and exchange that information with the other MAJCOM SCTCs.

At the time of this writing there were 44 SCTCs reportedly in existence within the Air Force community and a total of 62 in all of DOD. The OPR for each SCTC is listed, along with a point of contact and a telephone number, in Air Force Recurring Publication 700-2, Byte Line.

However, of all the SCTC catalogs reviewed, the one found to be most useful for the purposes of designing a conceptual schema was that published by the AFMPC SCTC. It provided what was considered to be the most concise and complete format observed. It was laid out in an easy to read format and contained all the vital areas of interest considered in Chapter One and considered to be necessary to provide a complete analysis of a software package. Figure 5 illustrates this format.

Within the civilian community, Arthur Andersen & Company has conducted a survey of software for physical distribution every year since 1981. In 1981 and 1982 there was only one software package identified out of a possible 67 total packages in 1981 and 80 total packages in 1982 that could be used on a microcomputer. (Chow, 1984:472) These numbers have increased along with the increased acceptance of microcomputer technology within the field of logistics.

The 1985 edition revealed that there were 165 packages out of a total 348 packages capable of being implemented on a microcomputer. The 1987 edition, with a considerably greater number of software packages surveyed, still only indicated a possible 293 programs out of a total of 990 that were capable of being run on a microcomputer.

The programs in these surveys were classified according to the logistics functions that they supported. The functional areas identified that would be of signifi-

# AFMPC Software Catalog Format

**TITLE:** (Title of software)

**FILE NUMBER:** (SCTC use only)

**COMPUTER:** (System that software will run on -- compatibility)

**ENVIRONMENT:** (Special configurations and system requirements)

**AUTHOR/POC:** (Author/Point-of-Contact of software)

**LANGUAGE:** (Software language)

**UNIT:** (Unit of author/POC)

**DATED:** (Date of software)

**BASE:** (Base of author/POC)

**FUNCTIONAL AREA:** (Type of software)

**AUTOVON:** (Phone number of author/POC)

**SOURCE AVAILABLE:** (Availability of software source code)

**NUM OF DISKS:** (Number of disks required)

**DESCRIPTION:** (Description of software)

**DOCUMENTATION AVAILABLE:** (Availability of documentation)

**SOURCE: HQ AFMPC SCTC**
**Software Catalog**
**June 1988**

**FIGURE 5**

cance to a transportation squadron were Transportation Analysis, Order Processing, Traffic Planning and Control, and possibly Inventory Planning and Forecasting. (Arthur Andersen & Co., 1985:13) Other possible areas of interest not mentioned in the Arthur Andersen catalog include Transportation Performance Measurement, Fleet Management, and Overall Management and Control of Transportation. (Chow, 1984:476-482)

Within each functional area listed, the software programs were broken down according to a variety of factors, including:

| | |
|---|---|
| System Name | Documentation |
| Vendor | Training |
| Price | Installation Assistance |
| Warranty Period | Hardware |
| Maintenance Fee | Language |
| Installations (#/First) | Functions |
| Update (Frequency/Last) | Comments |

The programs surveyed were listed by name in alphabetical order so that if one knew the title of a particular program, it could be easily located. In addition, if the user knew the name of the vendor, that person could also access a software program via the vendor's name as well.

It is important to remember that there exists a major difference between this catalog and the SCTC catalogs. The Arthur Andersen listing is made up exclusively of commercially offered software packages, whereas the SCTC catalogs are composed entirely of user developed software packages.

Implementing a Structure

The number of ways that a database could be structured are numerous. The number of databases with their own conceptual schema and cross-reference indices are also many in number. For instance, one database might list programs by name and then break them down into their applicable functional areas. Another database may be divided by functional area and then list all those programs falling under that functional area. The user could then go to whatever category is required and hopefully select an appropriate software package.

In selecting a possible schema, ease of use would be expected to be one of the most important factors. To most people, the computer is like an automobile, says Mitchell D. Kapor, founder of Lotus Development Corporation. They don't want to know how it works; they just want to get it in drive. (Carroll, 1987:25) In like manner, the conceptual schema chosen should be easy to use but effective in that it provides information essential to the proper selection of a software package. Having it in an easy to read format would also contribute to the likelihood of users taking advantage of it as an effective management tool.

Keeping these factors in mind, the following conceptual schema was developed to be used with the software catalog proposed:

Major Category:

Functional Area:

Title: Cost:

Description:

Hardware Environment:

General Information:

Author/Manufacturer:

POC:

A description of each area covered follows:

- Major Category: identifies the section of a Transportation Squadron in which the software programs listed could best be utilized; enables users to access only those programs pertaining to that section of Transportation with which they are primarily concerned.

- Functional Area: this would identify which area within a given section of a Transportation organization would benefit most from this particular program; for a list of possible functional areas, see Appendix 1.

- Title: simply lists the name of the program.

- Cost: only applicable if software happens to be a commercial product.

- Description: an abstract of what the program will do along with a mention of some of its limitations.

- Hardware Environment: identifies the hardware required; the operating system required; and the amount of RAM required.

- General Information: indicates such things as the language the program is written in; availability of documen-

tation; the most current version available; the date of the last update; the number of disks the program consumes; and possibly some measure of its ease of use (if known).

-Author/Manufacturer: gives credit to the originator of the program.

-POC: Point-of-Contact to obtain a copy of the software or to ask questions about the operation of the software.

Summary

A database structure such as this could be set up individually for both Vehicle Operations and Vehicle Maintenance or it could be a collective amalgamation of software products. In addition, at some later point in time, it might be expanded to include additional areas in the transportation field, such as the Traffic Management Office.

After each program selected has been analyzed in the manner prescribed and placed in the appropriate category, the end-user could then simply choose the program package which offers the most options for that person's requirements.

# III. Methodology

## Overview

The overall objective of this thesis was to examine the possibility of creating a database of available microcomputer software programs for use by personnel within the fields of Vehicle Management and Vehicle Maintenance to better facilitate the use of microcomputers within these organizations.

The main objective of a database environment is to provide a consistent, accurate, accessible, and controlled pool of data to serve the information needs of a growing community of users. The benefits include improved data quality and availability, and reduced costs for supporting users' needs. (Loomis, 1987:17-18)

To fulfill the overall objective of developing a usable database of value to transportation managers, four subordinate objectives were pursued. These were to:

(1) develop criteria for assigning software programs to a sample catalog;

(2) determine the characteristics and structure of the catalog;

(3) survey civilian and military transportation operations for available microcomputer software; and

(4) compare and contrast computer software programs with the criteria established for possible assignment to the catalog.

This chapter discusses the approach and techniques used to satisfy each of the stated objectives. In order to provide guidance in pursuing these objectives, answers to the investigative questions given in Chapter 1 were sought. The results are as follows:

Investigative Question 1: Define the functional requirements necessary for a catalog of microcomputer software to be used by Air Force Vehicle Management and Vehicle Maintenance personnel.

In addition to reviewing AFR 77-310, Vol I and AFR 77-310, Vol II, attempts were made to contact individual members of the TSIP. Unfortunately, TSIP did not prove to be an active organization. It was discovered that the TSIP had not been convened for about a year. Thus, no inputs from this organization were received. The functional requirements of an Air Force ground transportation unit as determined by current Air Force regulations are listed in Appendix I. The final selection of software to be included in the catalog was also aided by the experience of the author as both a Vehicle Operations Officer and a Vehicle Maintenance Officer.

Investigative Question 2: What commercial or military software programs are available to meet the functional requirements stated in the previous question?

A review of catalogs published by a wide variety of sources was made. The information contained in these catalogs varied considerably. Whereas one catalog may have listed only the names of selected software packages, another catalog might have listed a whole compendium about each

software package listed. A few of the more prominent catalogs that were used in the search included the Datapro Directory of Microcomputer Software, Arthur Andersen & Co.'s Logistics Software: 1987 Edition, Microcomputers in Transportation: Software and Source Book, published by the U.S. Department of Transportation, and Traffic Management's 1984 and 1988 annual directories of Transportation/Distribution Software. In addition, 11 of the 44 MAJCOM SCTCs listed in AFRP 700-2 were surveyed, along with one SCTC not listed in that publication. A review of the software listed on the Dial-A-Log bulletin board was also made. A sampling of the available software uncovered is listed in Appendix II.

Investigative Question 3: What criteria should be used in selecting software programs to be included in the proposed catalog?

A survey of the literature revealed a few general guidelines to be followed when selecting software.

1. Define your requirements. If one fails to adequately define their requirements, the chances of selecting software sufficient to meet their needs are drastically reduced. Users should identify what functions, features and information they will need to do their jobs. Managers should determine what future needs will need to be satisfied. The constraints of available hardware and funding may determine to a large extent what software may be selected.

2. Identify the alternatives. Survey what is available and then reduce the selection according to previously identified constraints.

3. Standardize the evaluation. An objective evaluation of possible software programs will legitimize the selection process and reduce future frustrations and expenses. Some of the factors that should be considered in evaluating the acceptability of proposed software are performance, cost reliability, availability, compatibility, modularity, technology, ergonomics, and support. Only those programs that possess all or most of those features deemed essential or desirable should be considered further.

4. Evaluate the alternatives. Upon narrowing the selection, do an economic analysis of the cost of the programs and a reliability analysis of the vendors. A demonstration of the final candidates as well as a review of available documentation is highly desirable but not always possible.

5. Make the final selection based on the facts, not on personal biases. By covering all the bases, and with sufficient effort, the software program chosen should be the one most capable of effectively and economically meeting one's needs as identified. (Stratton, 1986:24-26)

In addition, the software chosen should be flexible enough so that it can be easily customized for various operations. It should also be designed so that any person

can operate it with little training. The software chosen should ideally be able to handle large amounts of data and be capable of retrieving desired information quickly. It should be capable of performing currently acceptable problem analyses and provide accurate solutions. And finally, it should be capable of producing reports in the desired format. (Paterson, 1983:32)

Although the limitations imposed upon this research effort prevented all of the aforementioned steps to be carried out in assembling the sample catalog, they are presented to the reader as a suggested method of actually selecting individual pieces of software.

Investigative Question 4: What current guidance or direction has been given for purchasing and/or developing computer software programs acceptable to the Air Force?

A review of current Air Force regulations was conducted. Among those investigated were AFR 700-26, Acquisition and Management of Small Computers and AFR 700-9, Vol I, Information Systems Standards.

According to AFR 700-26, upon initial receipt of a microcomputer, only that software specifically requested by the user or provided for through Air Force-wide requirements contracts is made available. Requirements for off-the-shelf applications software must be routed through the base and/or MAJCOM Information Systems Requirements board (ISRB) for approval. Only software for approved requirements would be

permitted to be acquired. It could then be purchased through normal contractual actions.

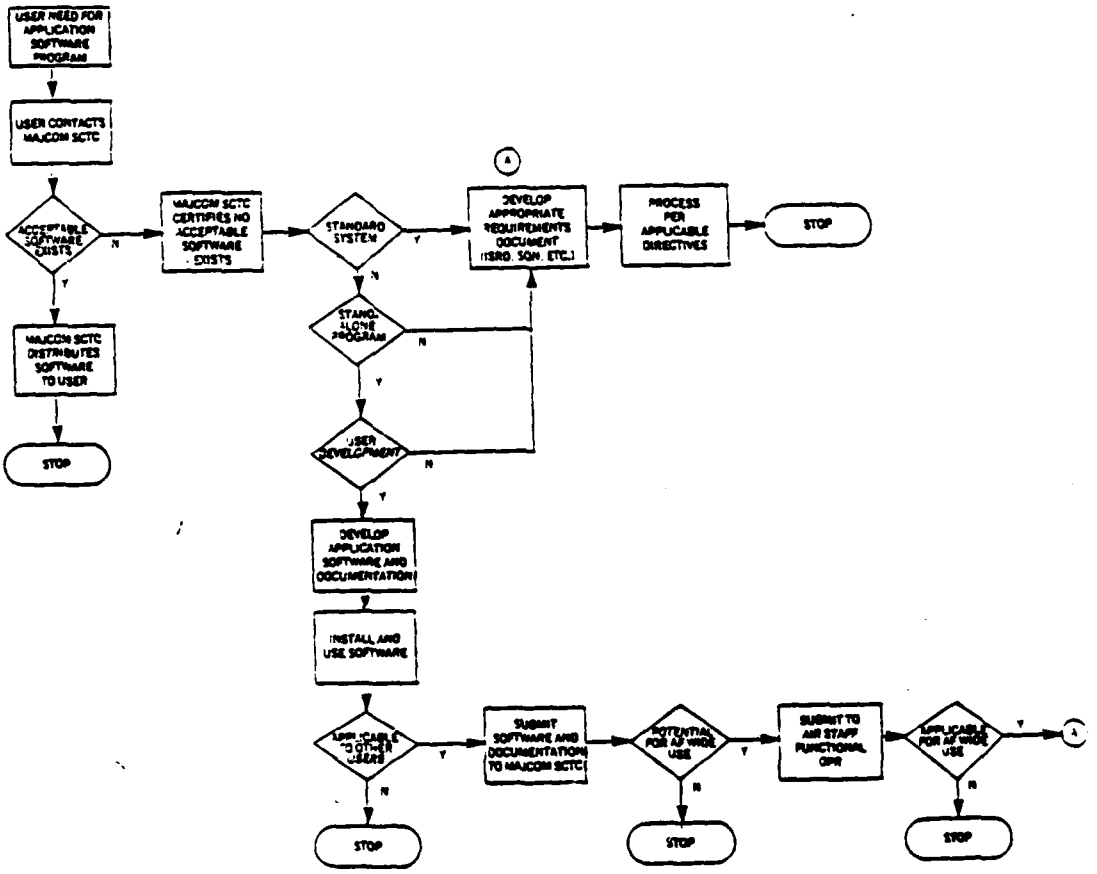
Before developing user specific software, users are instructed to first check with their MAJCOM SCTC for previously written software. If only software inappropriate for a given need are found, AFR 700-9, Vol I identifies accepted Air Force standard programming languages to be used in developing software applications. See Figure 6 for a diagram of the application software development process. (AFR 700-26, 1986:7)

Investigative Question 5: Are there centralized organizations within the Air Force keeping track of software being used and developed by subordinate units? If so, what cataloging attributes are currently being employed?

First, a review of Air Force regulations was conducted; in particular AFR 700-26. IAW AFR 700-26, each MAJCOM has been tasked to establish an SCTC. Each MAJCOM SCTC is chartered to keep a catalog and inventory of user-developed and user-submitted application software as well as vendor-supplied off-the-shelf software being used by their organizations. Exchange of catalogs between SCTCs is then to be performed on a periodic basis.

The intent of this program is to minimize duplication efforts in user-developed application software programs. Before developing new software, users are supposed to contact their MAJCOM SCTC to check for prewritten software

# Application Software Development Process




**SOURCE: AFR 700-26** **FIGURE 6**

or to receive certification that acceptable application software does not exist.

The MAJCOM SCTCs are not however, responsible for the life cycle management of user-developed software programs, nor are they intended to be software development centers. Maintenance of user-developed software is the responsibility of the individual who developed the software; as is the writing of the documentation. (AFR 700-26, 1986:8)

Once the selected management structure had been determined, an attempt was made to contact a pre-determined sampling of the SCTCs. Where possible, personal visits were made to the selected SCTCs. Where this was not possible, contact was made via telephone interviews. As many SCTC software catalogs were reviewed as was made available. The following is a breakdown of the SCTCs contacted:

| Major MAJCOM SCTCs Contacted | | Minor SCTCs Contacted | |
|---|---|---|---|
| MAC | AFSC | AFIT | AFLMC |
| SAC | AFLC | AFMPC | ESC |
| TAC | AFCC | MWR | ASD |

Problem Orientation

Since this research effort was primarily based upon the collection of secondary data, efforts were made to uncover all available listings of transportation related software programs. Although there was no presupposition that all possible software programs would be uncovered, the search was certainly intended to be an exhaustive one.

The research of secondary data was selected as the primary means of research because the focus of this thesis was not to create software application programs. Instead, it was intended to be a means of identifying those software programs already developed in order that a catalog of transportation software programs could be created that might be used to further enhance the use of the microcomputer within transportation management functions.

Data Collection and Analysis Procedures

It has been asserted in previous chapters that the microcomputer is poised for greater integration with virtually all management activities. It has been presumed by this researcher that although much lip service has been given to increasing the utility of the microcomputer, more effort is required in putting vital computer software programs into the hands of those who need it most before the use of the microcomputer by all levels of personnel can really expand.

In order to achieve the stated objectives, the following sequential steps were taken:

1. AFLMC was contacted to ascertain their role in developing or managing software. It was discovered that very little effort was given to managing software and only a limited amount of manpower could be allotted to developing specific application programs. Several projects were in

the works, but even more projects were found to be pigeonholed for some undetermined time in the future.

2. Next, HQ USAF/LET was contacted to determine if any cataloging system was being carried out at that level as a service to the various MAJCOMS. It was discovered that an advisory board (TSIP) had been formed that was composed of representatives from all the associated MAJCOMS. Attempts had been made through that association of representatives to coordinate efforts in consolidating a transportation software catalog. However, repeated efforts to initiate this objective by LET proved unsuccessful. (Jordan, 1988)

3. Attempts were then made to make contact with the various TSIP representatives to determine what transportation software programs were available and being used in the field. However, it was discovered that there was not an up-to-date list of current TSIP members along with their telephone numbers or full addresses. A message was forwarded to LET with the request that it be distributed to current TSIP members, but this request was never fulfilled.

4. It was discovered through conversations with LET personnel that there existed Air Force regulations governing the development and management of user-developed microcomputer software. These regulations were then researched to ascertain the specific Air Force strategy for managing EUC.

As previously discussed, AFR 700-26 laid out a management system based upon Small Computer Technical Centers at each MAJCOM. These SCTCs were designed to manage the collection and development of user-developed software as well as excess vendor supplied software.

5. Attempts were then made to contact as many SCTCs as possible. The author interviewed personnel either by phone or in person who were performing duties in the SCTCs. The intent of these interviews was to ascertain to what extent cataloging activities were presently being carried forth and what type of management control was needed to make such a program successful.

6. Efforts were also pursued to uncover as much civilian industry software as was possible. An intensive literature review was undertaken to accomplish this goal. Literature examined during this review included books, periodicals, journal articles, and catalogs dealing with the use of microcomputer software within the field of transportation. Although the search for software was intended to be exhaustive, it was by no means intended to be all inclusive; rather it was intended only to exemplify some of the major trends now occurring in software development within the transportation sector.

7. In both the literature review and the investigation of available in-house developed software, techniques for

cataloging were being noted so as to get ideas for a likely structure that could be imitated with the proposed catalog.

Upon completion of these steps, the four subordinate objectives stated at the beginning of this chapter were able to be achieved. The results of which are presented in the next chapter.

Summary

The preliminary research plans for data collection and description of methodology provided an initial direction to this research effort. The information collected in the completion of the four subordinate objectives provided the data needed to develop the structure of a useful cataloging system and select software appropriate for the purposes of the proposed catalog.

By investigating the current methods used to catalog software and the current efforts being given to such a task, the overall objective of this thesis was accomplished. That is, to examine the possibilities for creating a database structure that could then be used in constructing a catalog of available transportation related software for use by all functional areas within the Vehicle Management and Vehicle Maintenance sections of a ground transportation squadron. The results of that examination are presented in the following chapters.

# IV. Data Analysis

## Chapter Overview

This chapter discusses the results of the efforts taken to satisfy the four subordinate objectives stated at the beginning of Chapter 3. Each objective is analyzed, and the methods used to achieve each objective are discussed.

In addition, an analysis of the software programs uncovered is presented. The different types of software found are mentioned, as well as a discussion of those functional areas for which no software was found. The difficulties encountered in searching out the software as well as a few comments on the Air Force's selected method of controlling EUC are mentioned.

## Results

The intent behind accomplishing the four subordinate objectives was that once they were completed, then the ultimate objective of creating a software catalog for transportation professionals would also be achieved. With that in mind, the subordinate objectives and their resolutions are now presented.

### Subordinate Objective 1: Develop criteria for assigning software programs to the catalog.

The decision to assign a software package to the proposed catalog was a critical decision because it ultimately would affect the final composition of the catalog.

As stated in the Limitations section of Chapter 1, only software capable of being run on a microcomputer was to be considered. In addition, it was quickly discovered that even this seemingly simple limitation needed to be more specific. Only software capable of being run on an IBM PC/XT/AT or compatible microcomputer was to be considered.

This then restricted the software considered to those programs written for either a PC-DOS or MS-DOS operating system. Since the large majority of microcomputers now being used by the Air Force are Z-248s that utilize the MS-DOS operating system, this criterion was met.

Further consideration was given to the cost of the software programs. Since a few of the programs were found to be quite expensive, in the neighborhood of $10,000-$20,000, it was decided by the author to only consider software costing less than $1,000. This figure was chosen so that individual squadrons could have the option of purchasing a particular program had the Air Force chosen not to purchase that piece of software in large quantities. This figure was an arbitrary one which the author felt would be affordable to most squadrons and yet still allow many packages to be included in the selection process. Although it would undoubtedly eliminate many packages from consideration, it was felt that sufficient software was available to meet the criteria established without forfeiting significant capabilities that might only be found in the more expensive software.

Additional criteria for assigning software programs to the proposed catalog were developed from analyzing the peculiar responsibilities of Air Force Vehicle Management and Vehicle Maintenance Sections. Those programs deemed helpful to the particular needs of the personnel of these sections were considered for inclusion in the catalog.

Subordinate Objective 2: Determine the characteristics and structure of the catalog.

A review of several software catalogs revealed that a common method used for structuring a catalog was to organize it according to the functional areas of concern for that particular catalog. It was therefore decided to organize the catalog according to the functional areas included in Air Force Vehicle Maintenance and Vehicle Operations Branches. The catalog would first be separated into two sections, one for Vehicle Maintenance and one for Vehicle Operations, and then each section would be broken down according to its functional areas. The entire catalog would be arranged in alphabetical order, first by Major Category, then by Functional Area, and finally by software package title.

As for the arrangement of the characteristics of each software package, the reader is referred to the 'Structural Development' and 'Implementing a Structure' sections of Chapter 2 for details on how the final setup of characteristics was determined.

Subordinate Objective 3: Survey civilian and military transportation operations for available microcomputer software.

Although a wide variety of pertinent applications was revealed, the primary focus of available software suitable for inclusion in the proposed catalog appeared to be centered around Fleet Management. This would not be unexpected since vehicle fleets typically represent a significant investment and management of that vehicle fleet is crucial to its integrity. Second to Fleet Management by only a few programs was Maintenance Control and Analysis. Next to managing the use and whereabouts of a vehicle fleet, maintenance of that fleet would be considered to be the second most critical element in maintaining its integrity.

The division between military oriented and civilian oriented software was found to be somewhat lopsided under the Major Category of Vehicle Operations. (see Figure 7) However, under the Major Category Vehicle Maintenance, the distribution was found to be a bit more even. The reason for this occurrence is presumed to be the fact that up until the last couple of years, Vehicle Operation Branches have not been exposed to a routine usage of microcomputers in conducting their daily operations. Whereas, in the area of Vehicle Maintenance, computerization - although not necessarily of the microcomputer design - has been in use in management activities for several years.

# ANALYSIS OF SOFTWARE PROGRAMS

| | Military Origin | Civilian Origin | Total |
|---|---|---|---|
| **Vehicle Operations** | | | |
| Vehicle Operations Officer | 4 | 1 | 5 |
| Operations Supervision | 1 | 5 | 6 |
| Dispatch Operations | 0 | 5 | 5 |
| Equipment Support | 1 | 0 | 1 |
| Fleet Management | 3 | 8 | 11 |
| Vehicle Operations Total | 9 | 19 | 28 |
| **Vehicle Maintenance** | | | |
| Vehicle Maintenance Mngt | 3 | 1 | 4 |
| Administration and Training | 6 | 0 | 6 |
| Maintenance Control | 0 | 8 | 8 |
| Materiel Control | 0 | 4 | 4 |
| Vehicle Maintenance Total | 9 | 13 | 22 |

FIGURE 7

Features varied between programs, but one or more of the following functions were able to be performed by most of the software selected:

1. Shop Management - including repair orders, drivers' reports, PM scheduling, vehicle repair history, diagnostic, work standards and parts inventory.

2. Vehicle Performance Analysis - analyzed the performance of a vehicle or group of vehicles.

3. Warranty - provided for component life expectancy, potential warranty claims and summary of warranty recovered.

Subordinate Objective 4: Compare and contrast computer software programs with the criteria established for possible assignment to the catalog.

Although ample software packages were made available for analysis, only a limited number were able to be included in the sample catalog composed for the purposes of this thesis. Of the several hundred software packages reviewed, only a small minority fell within the parameters established for possible inclusion in the catalog. Of these, only 41 were selected for inclusion in the catalog. This number represents only a small fraction of the total software packages currently available to the microcomputer user. The reader is referred to Appendix II for the assembled catalog of software.

Only those packages meeting the requirements established were included in the catalog. Many of the programs were simply too expensive to be included. Many others, although relevant to the field of Transportation, were not

directly applicable to the fields under consideration. A great majority of those not included dealt with the movement of cargo (e.g., selecting a shipper, determining rates, etc.). Although these programs would have been appropriate for a TMO function, they did not fall within the limitations of the sample catalog. They certainly would have been considered for inclusion in a more complete software catalog composed specifically for professional transporters.

The software programs listed in Appendix 2 attempt to establish a sample of how such a software catalog might be structured and indicates a number of the transportation software programs that might be included in such a catalog.

First, the catalog has been divided into two major sections. One is for Vehicle Maintenance and the other for Vehicle Management.

Second, each Major Category was subdivided into its respective functional areas. Whatever functional area was thought to be most appropriate for a given software package is where that package was then placed. However, as depicted in Figure 7, many of the packages had applications in more than one functional area. The most common multifunction combinations occurred in the Vehicle Maintenance Management and Vehicle Operations Officer functions. This is certainly understandable considering the nature of these functions. The second most common multifunction combination occurred in Maintenance Control and Analysis and Materiel Control. This

can be explained by the fact that, although very different in their missions, both are involved in parts usage tracking and the tracking of vehicle repairs.

Third, an alphabetical listing of all programs contained in the catalog is provided along with a functional code indicating under what functional area(s) that program can be found.

Difficulties Encountered

As mentioned in Chapter 3, Air Force SCTCs are intended to provide an immediate source of software information for using agencies. At the time of this writing there were 44 SCTCs reportedly in existence within the Air Force community and a total of 62 in all of DOD. The OPR for each SCTC is listed, along with a point of contact and a telephone number, in Air Force Recurring Publication 700-2, Byte Line.

The results of this research investigation indicated that each SCTC was on its own as to how it cataloged its software or whether it maintained an on-line system or not. One SCTC contacted, the MAC SCTC, maintained only an on-line system, but it did not prove to be very user friendly.

It listed software by a designated code and a short description. However, to obtain more specific information on a given software package, the user was required to download the entire catalog of software which then required de-archiving. Many of the personnel currently manning lower

echelon positions are new computer users, and the MAC SCTC setup did not seem convenient for their needs.

The archiving of a file is accomplished to allow large amounts of data to be squeezed into a small area. An entire SCTC catalog might be as much as 60 pages long, as was the HQ TAC SCTC catalog, or as short as 20 pages, as was the HQ AFMPC SCTC catalog.

When attempting to contact the AFIT SCTC, it was discovered that one did not exist. It had been planned for, but no funding or personnel had been designated to support it. This was despite the fact that the AFIT SCTC had been listed as an active SCTC in AFRP 700-2.

Four other SCTCs contacted from which catalogs were obtained, were the AFMPC SCTC, the ESC SCTC, the TAC SCTC and the AFSC SCTC. None of these however, listed any software peculiar to the functional areas found within a typical transportation unit. The AFMPC catalog listed a total of only 30 software programs, of which the large majority were of a very general nature. The TAC catalog contained many more software programs, but again, no programs peculiar to the needs of a transportation organization were found. The ESC catalog, like the other two, contained very general, administrative type programs. The AFSC catalog was the largest of the bunch, but it too contained no programs specific to the needs of a Transportation organization.

User catalogs were found to be typically not available on an individual basis but instead were intended only for exchange between SCTCs and thus could be accessed only at the SCTCs. A major flaw with this system is that not enough people are aware that these centers even exist. If a user's office is not on distribution for AFRP 700-2, then it may prove difficult for that user to contact the appropriate SCTC. However, if a user is not aware that the SCTCs exist, then he/she more than likely will not know that AFRP 700-2 exists either, and will therefore not request to be on distribution for it.

Interestingly though, of the three SCTCs personally visited by this author, two separate catalogs were found at one, four separate catalogs were found at the other, and none were found present at the third. Hence, out of a reported 44 SCTCs within the Air Force supposedly exchanging catalogs with one another, only four separate catalogs were observed at the three locations visited. Those catalogs observed were from the following SCTCs:

TAC SCTC Software Catalog - 234 programs listed

AFMPC SCTC Software Catalog - 30 programs listed

ESC SCTC Software Catalog - 235 programs listed

MWR SCTC Software Catalog - 23 programs listed

Although not all of the SCTCs listed in AFRP 700-2 were contacted, it was considered significant that of those

personally visited, such a small sampling of catalogs were actually observed.

In addition, when contacted by telephone, the MAC SCTC reported that they did not have a current copy of one of their published catalogs available for review. The AFLC SCTC stated that they also did not have a current catalog available and that one would not become available for at least another six months. The AFIT SCTC, as previously mentioned, existed only on paper and therefore did not have a published copy of their catalog available.

Ironically, the SCTC which proved most helpful to this author, and which seemed the most organized and able to assist its designated users was not even listed in AFRP 700-2. As a matter of fact, this SCTC was not even officially recognized, but had been set up with a civilian contractor by its using agency. The SCTC being referred to was found at the Aeronautical Systems Division (ASD) located at Wright-Patterson AFB, OH.

As it turns out, ASD had negotiated a $10 million contract over three years to fund its small computer support center. The intent of the program sounded similar to the intent of the Air Force SCTC program - to provide in-house expertise on microcomputers.

Included within the contract was a Small Computer Demonstration Area staffed with contractors and equipped with a sample of small computer hardware and software on the

Air Force Standard Requirements contract, as well as other hardware and software. The demonstration room staff provided services to support, exchange, develop, modify, test, and evaluate new software/hardware configurations. If a software application was needed, but not available, the contractor was authorized to research, design, and deliver the needed system to the requesting organization.

Officially, ASD falls under HQ AFSC which has its SCTC located at Andrews AFB, MD. When questioned about its knowledge of the existence of the ASD SCTC, the AFSC SCTC acknowledged that one existed, but referred to it as a "one-man shop which wasn't yet fully operational."

Apparently, ASD is not the only facility to utilize a commercially run operation, either. Hill AFB, UT has an operation similar to ASD's which happens to be run by the same civilian contractor. There are apparently others in the field as well.

Although the Air Force SCTCs ideally should be able to perform services similar to that being provided by this contractor, that did not seem to be the case. Most complained of inadequate manning and limited funding.

If this program is to fulfill its original charter, which was to assist organizations in their utilization of the Air Force's massive investment in microcomputers, then more command attention is needed. Perhaps ASD, in its

efforts to take care of the needs of its users, has set forth an example worth emulating.

## Conclusions

The results of this investigation showed that, as proposed by the Rockart and Flanning studies (see Chap 1, p.12), little attention had been given to the control of EUC. Programs had been set up to manage the development of software application packages, but in reality, little was actually being accomplished in the way of controlling EUC within the Air Force environment.

The microcomputer, with its user friendly but sophisticated software, is performing many general management functions that were previously done manually, done infrequently, or which were not done at all. Although there are ample software programs available, only a small percentage may actually be able to meet the prescribed needs of a peculiar military organization. The need for a computer software catalog dedicated exclusively to specific military organizations would appear to be a foregone conclusion.

Part of the reason why EUC is not being properly managed within the Air Force is believed to be because no such centralized cataloging systems exist for the various military organizations. Thus, EUC serves as a ready source of new ideas for software development. As long as inadequate means are made available to provide for the software needs of thousands of users, organizations will do

whatever is necessary to provide application software required to meet the needs of the mission.

And as long as budgetary constraints, with its limited funding and limited manpower allotments, force organizations to continually do more with less, the use of the microcomputer will be a necessary mainstay to make up the difference.

In times such as we are currently experiencing, where computer software programs are being turned out literally overnight, there must be some means of tapping this vast resevoir of available resources. A dedicated computer software catalog would serve just such a purpose.

# V. Conclusions and Recommendations

## Overview

The purpose of this thesis was to examine the current potential for the implementation of database technology as a viable means of enhancing the capabilities of Air Force computer hardware resources through the cataloging of pertinent transportation oriented software programs.

Despite the proliferation of computer-based technology, few transportation organizations are adequately prepared to effectively manage the acquisition, implementation, and ongoing support of computer software development. As a result, many organizations have either not made full use of the new technology being made available, or have become vulnerable to depending upon end-user computing for developing required application programs.

## Further Discussion

Database processing systems supported by DBMS software are being used by more and more organizations with large computers, minicomputers and even with some microcomputer systems. (O'Brien, 1982:359) The integrated nature of common databases stored on direct access storage devices and the use of DBMS software provides users with easy access to specific information. Updating and maintaining the database, producing documents and reports, and responding to user inquiries, all require access and search capabilities,

and are easily handled by modern data processing systems. (O'Brien, 1982:360)

Several advantages of database processing systems, have already been mentioned. Database processing systems reduce the duplication of data and integrate data so they can be accessed by multiple users. Users can be provided with an inquiry/response capability which allows them to easily obtain needed information. Control and security of the data stored in databases is significantly increased since all access to data is controlled by the database management system.

In most cases, the benefits of database processing systems far outweigh their limitations. Database processing systems increase the productivity of users by providing information more efficiently and effectively than file processing systems. Users can more easily get the information they need in less time using the database approach.

Thus, the use of a transportation software cataloging system that is controlled by a centralized data base management system would provide computer users with easy access to specific information on pertinent programs available as well as providing a means of allowing transporters to communicate worldwide via a common communications network. Appendix III lists a couple of such networks dedicated to professional transporters that are now in place. If these are available

in the civilian sector, why hasn't the United States Air Force been able to establish one?

In fact, there is such a network within the military sector. It is entitled TRANS System, and is run out of SAC Hq. The irony is, this network is currently being threatened with termination due to insufficient usage. It currently lists no software available to transporters, but merely serves as a communication link. It is capable of being accessed worldwide via the Defense Data Network (DDN). TRANS System has been so inadequately promoted that neither the SAC SCTC nor the Transportation Instructors at AFIT were aware of its existence. It is understandable then that this network is currently being threatened with elimination. Since this network is already in place, it might be a good candidate for the incorporation of the proposed database.

Direct Application

According to the latest figures, the United States Air Force operates 140 major installations worldwide. (Air Force SUMMARY, 1988:D-36) Whether the mission is that of a mobile Red Horse unit or of a motorpool supporting TAC fighter wings or MAC C-5s, C141s, or C-130s, the basic mission of a ground transportation unit remains the same - effectively managing the wing's ground transportation vehicles in such a manner that there are sufficient numbers of the required types of vehicles and equipment available to support the mission of that wing.

Transportation management involves a distillation of the strategic and tactical planning process which is entailed in the overall management and operating control process. According to AFR 77-310, Vol II, para 1-53, the Chief of Transportation has overall responsibility for making sure that vehicles and equipment are maintained in a safe, reliable, and serviceable condition with the least expenditure of manpower, funds, and material. The capabilities of current database technology could provide tremendous assistance in allowing Chiefs of Transportation to carry out their duties with the utmost of efficiency.

It is now generally recognized that overall organizational effectiveness is a function of the quality of human productivity. That quality often depends upon information content, form, precision, and timeliness. Productivity depends upon information cost, convenience, and availability. Thus an organization's effectiveness can be directly affected by the quality and availability of a software cataloging system.

There are a number of quality and productivity benefits that could accrue from the implementation of a Transportation Software Cataloging System. These include the following:

1. Improved decision-making: A few programs are capable of acting as Decision Support Systems (DSS). These systems do not make a decision; they aid the decision-maker

in making a more analytical decision by supporting a variety of unstructured decision processes. Demonstrable benefits of such systems are faster decision-making, improved consistency and accuracy, and improved methods for analyzing and solving problems.

For example, a program such as Vehicle Cost Analyzer is set up to allow Fleet Management to make a sound recommendation as to whether a particular vehicle should receive additional repairs or whether it would be more economical to replace it. Although these decisions are admittedly being made routinely without the benefit of a DSS, the integration of a DSS into the decision-making process would help those decisions being made to be more precise. Increased accuracy would be assured through the utilization of a rational, economical, systematic, and consistent process for making decisions regarding purchase, maintenance, and replacement that would minimize vehicle costs.

2. Increased managerial and professional productivity: Being able to select and use appropriate software packages will allow professional transporters to take on bigger and more complicated tasks while at the same time performing them faster and more efficiently then could have been possible by attempting to accomplish them manually.

By using a program such as Super Project Plus, a manager would be better able to exert greater control over tasks, resources, budgets and scheduling. A program such as

this typically incorporates such analytical tools as PERT, CPM, and Gantt charts to support a variety of tasks, subtasks, milestones and resources.

Moreover, by making microcomputers easier to use via carefully selected (perhaps menu-driven) software, more people at lower echelons and with less training would be able to answer questions and perform services which previously were required to be elevated to higher ranking personnel. Thus, personnel in higher echelon managerial positions should have more time to do those things such as planning, programming and budgeting that make better use of their level of talent and skills.

3. More responsive service: Software packages such as Service Monitoring Package would enable Dispatch Operations to maintain a passenger count by run and route for a one month period. The package is configured to handle up to one year's data at any given time. This could save numerous manhours of similar analysis performed manually.

A software package such as Roadsearch Plus quickly determines shortest routes, mileages, travel times and expected fuel usage in concise reports that can be individually developed and distributed as needed. It is considered safe to presume that no such service is currently being offered by any Vehicle Dispatch Operations section within the Air Force.

4. Reduction or displacement of operating costs: Given Vehicle Maintenance's need to keep track of a multitude of information such as PM schedules, warranty information, parts availability, vehicle maintenance history files, and productivity of individual mechanics, the use of a program such as Fleet Maintenance Management System or Transportation Information Management System would allow a Maintenance Control and Analysis section to perform these functions more efficiently and with less people, thus conserving valuable and dwindling reserves of military resources.

## Conclusions

The microcomputer represents a potentially significant component of a transportation organization's information management system. The availability of low cost microcomputers has made computer technology more accessible, and the development of user-friendly software has made the computer easier to use at all levels of the transportation organization. Microcomputers may prove their greatest value to be in effecting the capacity, and readiness of transportation professionals to be responsive to new approaches to management and planning.

However, in order to provide the management assistance that a microcomputer is capable of providing, it requires the appropriate software programs with which to operate. As previously mentioned, the creation of the

necessary programs is not only expensive and extremely time consuming, but at this point in time, is often unnecessary. Sufficient programs have been created and made available for distribution so that it is usually no longer necessary to create from scratch a program to meet one's functional requirements. Properly selected and installed, packaged software can greatly reduce system development cost, elapsed time, and organizational impact.

The only stipulation is that the one needing the program is made aware of the existence of a program matching that person's needs. Something more is required than is presently available within Air Force operations to create a marriage between what is available and what is required as regards the procurement and use of computer software.

In addition, something is needed to help the Air Force progress from a stage whereby personnel are allowed to freely manipulate a valuable organizational resource, to a stage whereby just enough guidance is administered to ensure quality work without hampering innovation. One must walk a fine line in order to achieve both of these objectives. However fine the line, the drawing of such a line must not be neglected.

The cataloging system proposed by this thesis would serve both of these objectives. The marriaging of needs and alternatives could take place while at the same time encouraging the progression from a stage characterized by a limited

control of the hardware without much attention to another valuable resource, the software, to a stage characterized by increased accountability, shared data, and common systems. The potential orgainzational impact could be tremendous.

Recommendations

The purpose of this thesis effort was to provide a starting point in evaluating and selecting transportation oriented software packages by looking at what has influenced Air Force software management in the past, assessing current efforts to manage software, and look at future challenges. It is the belief of this author that if properly used, the cataloging system proposed can be an extremely valuable resource for Air Force transportation managers in identifying, evaluating, and selecting software to satisfy their mission requirements.

As pointed out in Figure 7, the greater majority of the programs uncovered were found to be from civilian sources. Over 67% of the software found to pertain to Vehicle Operations and over 59% of the software pertaining to Vehicle Maintenance had civilian origins. This would seem to indicate that either the Air Force is fostering insufficient attention to the development of needed software for transportation professionals or insufficient numbers of adequately trained personnel are available to develop software dedicated to the needs of professional transporters. Either more computer training should be made available to

professional transporters or more personnel need to be made available to assist different organizations in developing needed software programs.

The functional areas where the least amount of applicable software was found were Equipment Support and Materiel Control. This may indicate that either little automation is needed in those areas, or these areas need considerable expansion of computerized attention.

In the case of the Equipment Support function, the former may be true. However, even a simple database program would be considered helpful in maintaining multiple lists of equipment and its location.

As for the Materiel Control functior, it came as a surprise that more programs were not available that pertained to this very important function. In this case, it would seem that a more complex database program would be required to monitor the whereabouts and status of hundreds of individual tools and parts.

The relatively inexpensive microcomputer has allowed computers to be introduced to a widening spectrum of people who are now becoming acutely aware of how the computer can assist them in performing their assigned tasks. Increased productivity and performance through integrated decision making that considers all relevant tradeoffs, is timely, and uses current information, can be expected through the increased utilization of the microcomputer in today's Air Force.

A database of transportation related computer software programs will provide valuable services for many users. However, the success of this program is dependent upon improvements in top management support, users' satisfaction and adequate training. The following are recommendations to alleviate these problems:

1. Start a vigorous campaign to publicize the Transportation Software Database.

2. Spend time contacting and encouraging top and middle level managers to use the system.

3. Emphasize the benefits of such a system to transportation managers.

In order for an information system such as the one proposed to be considered truly successful, there must be top management comprehension and commitment. Until they are attained, there is little hope of achieving what one might consider complete success.

DOD personnel must make changes in mindset, form, and substance - the total picture - in order to improve the way we do business. Change will come gradually, not overnight, but it must be done. As stated by Dr. Robert Costello, Under Secretary of Defense for Acquisition, at the commencement ceremonies for the 88-1 graduating class at the Defense Systems Management College in May 1988, "Changes must be initiated at the top, encouraged at the top, implemented at the top, and led at the top. Top management must be committed to change, and then follow through to accomplishment". Dr. Costello concluded his comments by saying,

'it takes leadership to convince people and established institutional processes that changes will make everyone's job easier, and provide the best and least expensive systems for the field.' (PMC 88-1, 1988:6-7)

In addition, for the catalog developed to be truly successful, it must be frequently used by those requiring it the most. In order for this to occur, the implemented system must meet the following capability requirements:

1. Usability - the system chosen should be easy and convenient for non-technical personnel to use;
2. Data - the system chosen should be able to provide access to both civilian and military sources of available software; and
3. Analysis - the system should have analysis capability to support a wide variety of users and functional areas.

As microcomputer hardware becomes more widely dispersed, and more and more personnel are exposed to advanced computer technology, the trend toward end-user computing is irreversible. It will require significant management attention in the years to come.

The success of the DOD in its efforts to defend this nation have become increasingly dependent on up-to-date technology and technology-wise managers. As a consequence, the user-managers of the near future will no doubt utilize the microcomputer as a natural and integral part of their daily problem solving activities.

As such, some sort of on-line communication link with access to an official software bulletin board dedicated to

the needs of a given organization, such as Transportation, is becoming increasingly more essential.

Concluding Comments

This thesis has presented an approach to the development of a catalog of software dedicated for use by transportation professionals. The guiding premise has been that, given the right software, transportation managers can choose those which will help them to challenge the traditional ways of doing business and lead to decisions which will sustain and improve organizational performance.

The approach that has been suggested is the establishment of a database of available transportation-related computer software programs. A sample catalog has been proposed which serves to isolate those programs which will unite the various concerns of the modern transportation manager.

In an examination of the programs currently available, the model was shown to be flexible enough to account for the distinctive characteristics of each subfunction of a ground transportation unit, while providing a common basis of comparison of the various transportation programs on a functional and more general basis.

In conclusion, the approach presented to the development of a comprehensive software catalog exclusively intended for use by Air Force transportation professionals in selecting computer software suggest that transportation

managers must develop their computer skills and their awareness of the programs available which can help them utilize the microcomputer as an effective management tool. Their ultimate performance will, sometime in the very near future, be judged by this awareness. The transportation cataloging system proposed by this thesis serves as an example of what can be done if only more time and attention is allowed for such an operation.

The use of the cataloging system suggested requires a critical examination of the traditional management assumptions about the process of providing transportation services. Rather than being bound by the notion of "but that's the way it has always been done," the successful transportation manager will need to understand how to adapt to a rapidly modern and expanding technology while exploiting the opportunities to apply this technology to the field of transportation.

## APPENDIX I

## Responsibilities of a Ground Transportation Organization

I. Vehicle Operations

- A. Vehicle Operations Officer
- B. Operations Supervision
- C. Dispatch Operations
- D. Equipment Support
- E. Fleet Managemnet
  1. Vehicle Control
  2. Fleet Analysis
  3. Quality Assurance Evaluation
  4. Operator Records and Licensing

II. Vehicle Maintenance

- A. Vehicle Maintenance Management
- B. Administration and Training
- C. Materiel Control
- D. Maintenance Control and Analysis
- E. General Purpose
- F. Special Purpose

# APPENDIX II

A

SAMPLE CATALOG OF

TRANSPORTATION SOFTWARE

Major Category: Vehicle Maintenance

Functional Area: Administration and Training

Title: Automated DD Form 173 Cost: Public Domain

Description: An interactive program used to enter and save a DD 173/1 message. In addition, previously saved messages can be retrieved, modified, and reprinted. This program will support color monitors and single sheet or continous form DD 173/1.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in BASIC; last updated in August 1984;

Author/Manufacturer: HQ SSC/PRRCC
Gunter AFS, AL 36114

POC: AV 446-4571

Major Category: Vehicle Maintenance

Functional Area: Administration and Training

Title: FORMS

Cost: Public Domain

Description: The FORMS program is a form creation program. It allows for the creation of new forms, the editing of data on completed forms, and the completion of data insertion on forms templates created from within the program.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Last updated in March 1987

Author/Manufacturer: Steven Wright

POC: SSC/SMXXB-C
Gunter AFS, AL 36114-6343
AV 446-3194

Major Category: Vehicle Maintenance

Functional Area: Administration and Training

Title: Personnel Automated Tracking and Scheduling (PATS)

Cost: Public Domain

Description: PATS is a training scheduling system that was developed to track and schedule personnel through their various training requirements. It schedules on a calendar basis those periodic and one-time training requirements given the proposed class schedule.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in FORTRAN 77

Author/Manufacturer: AFLMC/LGM
Gunter AFS, AL 36114

POC: AV 446-4581

Major Category: Vehicle Maintenance

Functional Area: Administration and Training

Title: Typing Messages (DD Form 173) Using Wordstar — Cost: Public Domain

Description: AFR 10-1 allows the use of word processors and plain bond paper for message inputs instead of DD Form 173, if the message processing equipment can handle it. This file will assist in the construction of properly formatted text to use instead of DD Form 173.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Requires WORDSTAR word processing program; last updated in August 1986

Author/Manufacturer: TAC SCTC
1912 ISSG/SCTC
Langley AFB, VA

POC: AV 574-4966

Major Category: Vehicle Maintenance

Functional Area: Administration and Training

Title: Unit Administration Management System  Cost: Public Domain

Description: Maintains a database containing information on civilian personnel training, awards, addresses, etc.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written dBASE II

Author/Manufacturer: SSC/PRRCC
Gunter, AFS, AL 36114

POC: AV 446-4571

Major Category: Vehicle Maintenance

Functional Area: Administration and Training

Title: WORDSTAR Form Templates Cost: Public Domain

Description: This is a collection of templates for various forms. Included are APR, OER, Form 9, Staff Summary sheets, AF Form 2185, AF Form 2095, AF Form 2096, AF Form 162. AF Form 2212, AF Form 973, DD1 LForm 1610, and AF Form 601. The user opens the appropriate template for the corresponding form being completed and enters data in the designated areas. The file is then printed out onto the form.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Requires WORDSTAR Word Processing program; last updated July 1985

Author/Manufacturer: Unknown

POC: SSC/PRRCC
Gunter AFS, AL 36114-6343
AV 446-4571

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: CFAVMRS: Fleet Maintenance Management System — Cost: Contact Vendor

Description: CFAVMRS software tracks equipment maintenance and operating costs, analyzes repair detail, controls part inventory costs and analyzes parts usage. The software comes in four modules:

Module 1 reports include costs detailed by unit, by fleet or cost center, by class or equipment type, PM scheduling, cost summaries, exception reporting and equipment inventory

Module 2 provides more in-depth maintenance reporting with the tracking of detailed repair history. Labor productivity, warranty claims, and repair inquiries are isolated.

Module 3 creates parts inventory detail listings, cross-reference lists by manufacturer and/or part description, inventory activity reports, and physical inventory lists.

Module 4 provides more in-depth inventory reporting

Hardware Environment: IBM PC and compatibles

General Information: Over 300 current users

Author/Manufacturer: Computerized Fleet Analysis, Inc.
205 W. North Ave.
Villa Park, IL 60181

POC: (800) 437-6001

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: Fleet Care Software Cost: $895+

Description: This computerized vehicle maintenance system is designed for all types of fleet operations. This tool helps the user organize, summarize, and update the vast amounts of information needed to monitor today's fleet. The system tracks user defined service activities such as operations, repairs, parts inventory, scheduled maintenance, fuel usage, labor rates, and work order processing. The system is user friendly, generates over 20 listings and reports, and does not require prior computer operating experience. Standard features include work order processing, parts inventory management, preventive maintenance scheduling, mechanics' labor records, and vehicle operational reports.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS operating system; requires 512K RAM

General Information: Documentation included

Author/Manufacturer: Moscom Corp
300 Main St
East Rochester, NY 14445

POC: (716) 385-6440

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: Fleet Maintenance System (FMS) Cost: Contact Vendor

Description: This menu-driven system provides complete fleet reporting, and is intended for small to mid-size transportation operations. It covers six main service areas, including work order, tire use, part use, fluid use, preventive maintenance, and mechanic labor services. Extensive and flexibly acquired printed reports and terminal inquiries are provided within each service. Sample reports/inquiries include work order, part use, tire use, fluid use, fluid performance, preventive maintenance status, fleet operational status, and mechanic staff reports.

Hardware Environment: IBM PC and compatibles; PC/MS-DOS operating system; requires 256K RAM

General Information: User Manual and demo diskettes availaable in the U.S. for $25

Author/Manufacturer: Vectqr Solutions Systems Analysis Gp
1355 Terra Vista Lane
Colorada Springs, CO 80911

POC: (303) 392-8746

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: FLEET*MATE

Cost: Contact Vendor

Description: Designed for maintenance managers with no prior computer experience. It is completely menu-driven with on-line screen and entry displays. FLEET*MATE is available for single-user or multi-user microcomputer systems. FLEET*MATE consists of two integrated modules designed to help manage vehicle maintenance and control parts inventory. The basic capabilities of these modules are Vehicle Service Tracking; Vehicle Repair Tracking; PM Scheduling; Component Tracking; Parts Usage Tracking; Mechanic Performance Tracking; Fuel Usage/Inventory Tracking; Reorder Prompting; Stock Status Tracking; Parts Tracking; Parts Costing; Inventory Valuation; Inventory Usage Analysis; and Part Number Supression. FLEET*MATE is tailored to suit any situation by altering multiple factors.

Hardware Environment: IBM PC/XT/AT and compatibles; requires 256K RAM

General Information: Written in R/M Cobol; documentation included; 1st installed in 1984; 19 current users; two days training included; customizing available

Author/Manufacturer: Multisystems, Inc.
1050 Massachusetts Ave.
Cambridge, MA 02138

POC: J. William Rodman
Senior Transportation Analyst
(617) 864-5810

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: OnTime Cost: $495

Description: OnTime is scheduling software that controls as well as plans. It produces a schedule for all jobs and provides for optimum usage of resources, based on six available scheduling methods: FIFO, minimize avg completion time, weighted completion time, avg and range of job lateness, and number of late jobs. Actual times can be accumulated and reported along with budgets, time remaining, workloads and capacity forecasts. A 'what-if' analysis of alternate schedules can identify the optimum scheduling discipline and locate bottlenecks. Job status reports, forecasts, bar charts, route sheets, and work plans are produced. OnTime provides for efficient scheduling which directly improves productivity. Data files interface to dBASE, Symphony and Lotus 1-2-3 applications.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system; requires 256K RAM

General Information: Written in dBASE III; documentation included; 1st installed in 1980; 100 current users; maintenance included

Author/Manufacturer: Wyman Associates, Inc.
181 Second Ave, Suite 321
San Mateo, CA 94401

POC: (415) 343-3900

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: Transportation Information Management System (TIMS) Cost: Contact Vendor

Description: This package is a fully integrated transportation information processing system. Reports and analysis are derived from shop work orders and fuel usage. The system maintains a full perpetual inventory accounting of parts and produces parts and labor usage analysis. Preventative maintenance alerts can be established using calendar or miles parameters. The user can command information for any time parameter, any vehicle, or groups of vehicles by any outside agency and/or internal departments. Provides inter-budgetary costing on a monthly and yearly basis. The work order and fule loads histories provide maintenance management with a variety of operational reports. These include the Work Order History, Vehicle History with CPM analysis, and the Mechanic's Productivity analysis.

Hardware Environment: IBM PC/AT/XT and compatibles

General Information: In use at many school transportation and private transportation facilities throughout the United States; six month guarantee, user training, and telephone support available.

Author/Manufacturer: BISPAC Systems
P.O. Box 580
9256 Madison Ave.
Orangevale, CA 95662

POC: (916) 988-1111

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: UTILIFLEET Cost: $295

Description: This system lets users monitor their fleet to keep each vehicle running at maximum efficiency. The system will help users detect operational irregularities. The final result of UTILIFLEET is a cost per mile analysis for each vehicle and a bar-graph comparison of all vehicles. Up to 250 vehicles can be stored per disk and the following information is stored for each vehicle: serial number, year, make, model, odometer reading upon receipt, purchase price, date of receipt, vehicle weight, and operating costs.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system; requires 128K RAM

General Information: Unknown

Author/Manufacturer: Tecnomics Microcomputer Software
100 Ardmore St.
Blacksburg, VA 24060

POC: (800) 368-3532

Major Category: Vehicle Maintenance

Functional Area: Maintenance Control and Analysis

Title: Vehicle Manager Cost: Contact Vendor

Description: This system setup includes detailed inventory of each vehicle or piece of equipment's component parts. The system is work order driven with an integrated parts inventory. Reports show current inventory levels and detailed information on each component part, including list price, worst price and average price. Preventative Maintenance section allows the user to schedule PM operations by miles or days. The report shows PM Due or Late, and both summary and detail information per vehicle. A complete section on tires is available to track each tire individually in terms of history and location. The user can also track which vendor's tires (or components) last longer and how much longer. The Fuel/Oil section provides summary information on all fuel and oil purchases including graphs.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS operating system; requires 360K RAM

General Information: Written in dBASE; documentation included; 1st installed in 1986; 30 current users; customizing available

Author/Manufacturer: Compware
2332 S. Peck Rd.
Whittier, CA 90601

POC: (213) 692-0201
(800) 426-6792

Major Category: Vehicle Maintenance

Functional Area: Materiel Control

Title: FLEET*MATE

Cost: Contact Vendor

Description: Designed for maintenance managers with no prior computer experience. It is completely menu-driven with on-line screen and entry displays. FLEET*MATE is available for single-user or multi-user microcomputer systems. FLEET*MATE consists of two integrated modules designed to help manage vehicle maintenance and control parts inventory. The basic capabilities of these modules are Vehicle Service Tracking; Vehicle Repair Tracking; PM Scheduling; Component Tracking; Parts Usage Tracking; Mechanic Performance Tracking; Fuel Usage/Inventory Tracking; Reorder Prompting; Stock Status Tracking; Parts Tracking; Parts Costing; Inventory Valuation; Inventory Usage Analysis; and Part Number Supression. FLEET*MATE is tailored to suit any situation by altering multiple factors.

Hardware Environment: IBM PC/XT/AT and compatibles; requires 256K RAM

General Information: Written in R/M Cobol; documentation included; 1st installed in 1984; 19 current users; two days training included; customizing available

Author/Manufacturer: Multisystems, Inc.
1050 Massachusetts Ave.
Cambridge, MA 02138

POC: J. William Rodman
Senior Transportation Analyst
(617) 864-5810

Major Category: Vehicle Maintenance

Functional Area: Materiel Control

Title: LANTA Parts Inventory Package Cost: Public Domain

Description: Intended strictly for parts inventory and analysis. Allows user to track parts quantities and locations. Supports one user at a time, and it is most appropriate for small and medium sized transit agencies.

Hardware Environment: IBM PC and compatibles; requires 256K RAM

General Information: Written in dBASE II

Author/Manufacturer: Chase, Rosen & Wallace

POC: PC-TRANS
University of Kansas Transportation Center
2011 Learned Hall
Lawrence, KS 66045
(913) 864-5658

Major Category: Vehicle Maintenance

Functional Area: Materiel Control

Title: Materials Management Cost: Contact Vendor

Description: This system was designed to meet several basic management objectives including control inventory; establish usage requirements; verify vendor invoices; predict and record vendor lead time requirements; establish proper inventory levels; establish optimum purchasing quantities; provide exception reporting; provide a user friendly system; and provide system design that can grow with requirements.

Hardware Environment: IBM PC and compatibles; PC-DOS operating system; requires 512K RAM

General Information: Written in COBOL, BASIC; documentation included; maintenance available; training available; customizing available

Author/Manufacturer: Retail Concepts, Inc.
1022 Weiss, Suite 4
Frankenmuth, MI 48734

POC: (517) 652-3241

Major Category: Vehicle Maintenance

Functional Area: Materiel Control

Title: Vehicle Manager

Cost: Contact Vendor

Description: This system setup includes detailed inventory of each vehicle or piece of equipment's component parts. The system is work order driven with an integrated parts inventory. Reports show current inventory levels and detailed information on each component part, including list price, worst price and average price. Preventative Maintenance section allows the user to schedule PM operations by miles or days. The report shows PM Due or Late, and both summary and detail information per vehicle. A complete section on tires is available to track each tire individually in terms of history and location. The user can also track which vendor's tires (or components) last longer and how much longer. The Fuel/Oil section provides summary information on all fuel and oil purchases including graphs.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS operating system; requires 360K RAM

General Information: Written in dBASE; documentation included; 1st installed in 1986; 30 current users; customizing available

Author/Manufacturer: Compware
2332 S. Peck Rd.
Whittier, CA 90601

POC: (213) 692-0201
(800) 426-6792

Major Category: Vehicle Maintenance

Functional Area: Vehicle Maintenance Management

Title: Critical Path Program (CPM) Cost: Public Domain

Description: A methodology for determing critical tasks that, if not accomplished by a certain time, contribute directly to the delay of the entire project. Either a file or interactive input is possible. Produces Gantt charts.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in Turbo Pascal

Author/Manufacturer: HQ AFOTEC/SCTC

POC: Dial-A-Log

Major Category: Vehicle Maintenance

Functional Area: Vehicle Maintenance Management

Title: Super Project Plus Cost: $495

Description: A project management package that is designed to allow for greater control over tasks, resources, budgets and scheduling, regardless of industry or computer expertise. This package incorporates PERT, CPM and Gantt charts. Super Project Plus supports a number of tasks, subtasks, milestones and resources. It allows for the creation of 'customized' reports through the use of SuperCalc spreadsheets.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS or PC-DOS operating system; requires 320K RAM

General Information: Written in CBASIC; documentation included; 1st installed in 1984; maintenance available; customizing available

Author/Manufacturer: Computer Associates Micro Products
2195 Fortune Drive
San Jose, CA 95131

POC: (408) 942-1727

Major Category: Vehicle Maintenance

Functional Area: Vehicle Maintenance Management

Title: Suspense Log Program Cost: Public Domain

Description: This system is a menu driven program that allows automatic updating of weekly suspense actions. Reports of pending and completed actions are generated for each action group. There are 3 versions of the program included in this library; one for dBASE II, one for dBASE III and a compiled version.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Last updated September 1984

Author/Manufacturer: SSC/SSMCS
Gunter AFS, AL 36114

POC: AV 446-4571

Major Category: Vehicle Maintenance

Functional Area: Vehicle Maintenance Management

Title: TDY Tracker

Cost: Public Domain

Description: Maintains a database of TDY costs and prints a report from the data.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in dBASE II

Author/Manufacturer: Unknown

POC: SSC/PRRCC
Gunter AFS, AL 36114
AV 446-4571

Major Category: Vehicle Operations

Functional Area: Dispatch Operations

Title: Ridership Analysis System Cost: Public Domain

Description: The user inputs passenger count data from input sheets prepared by count-takers. The count data is accumulated for each selected bus and route, for both inbound and outbound directions. An edit routine permits easy correction of input errors. Detailed trip reports show passenger counts in and outbound, bus number and departure/ arrival times. Route analysis reports are produced which show for each route the inbound and outbound passenger counts, passengers per one-way trip and passengers per hour. This application was intended to be used for quarterly ridership analysis, but could be run on whatever frequency is desired.

Hardware Environment: IBM PC and compatibles; PC/MS-DOS operating system

General Information: Written in dBASE III; User's Manual available for $5.00; may require modifications to fit the needs of individual users.

Author/Manufacturer: Dobbins, DeGuire & Tucker, P.C.
3819 Stephens
P.O. Box 5026
Missoula, MT 59806-5026

POC: (406) 721-4550

Major Category: Vehicle Operations

Functional Area: Dispatch Operations

Title: Roadsearch Plus Cost: $74.95

Description: Roadsearch Plus is a computerized road atlas that helps plan trips. Roadsearch Plus computes and prints detailed driving routes with mileage, travel times, and fuel usage. A program determines the shortest route between cities. Other programs let the user develop routes which can be longer, but more suitable to their needs. Roadsearch Plus contains a database of 487 cities/road junctions located in the U.S.A. and Canada, and about 70,000 miles of road. A roadmap development system lets the user customize.

Hardware Environment: IBM PC/XT/AT and compatibles; requires 64K RAM

General Information: Written in Assembly Language; documentation included; 1st installed in 1982; 10,000 current users; telephone maintenance support available

Author/Manufacturer: Columbia Software
5461 Marsh Hawk Way
Columbia, MD 21045

POC: (800) 835-2246 x172

Major Category: Vehicle Operations

Functional Area: Dispatch Operations

Title: Service Monitoring Package (SMP) Cost: Public Domain

Description: SMP is a series of programs intended to keep track of route performance data and passenger counts for a fixed route transit agency. From these data a series of performance indicators are generated. As configured, the package will handle one year's data at any given time. Up to 99 routes may be defined for weekday, Saturday, and Sunday service each; any number of driver runs and daycards can be accommodated with sufficient disk storage space. Four reports are predefined. A passenger count report displays data by run and route for a one-month period. A block report provides a list of the runs serving each route and the passenger count for each run. A route report provides performance statistics for each route for any contiguous set of months in the year along with a summary report.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system; requires 512K RAM

General Information: Written in KnowledgeMan (a database management system); requires KnowledgeMan version 2.01 or later; User's Guide available separately.

Author/Manufacturer: Capital District Transportation Authority
Albany, NY

POC: TIME Support Center
Dept of Civil Engineering
Rensselaer Polytechnic Institute
Troy, NY 12180-3590
(518) 276-6227

Major Category: Vehicle Operations

Functional Area: Dispatch Operations

Title: Special Trips and Reservation Cost: Contact Vendor

Description: A reservation system for time slots, drivers, and vehicles. Special Trips are recorded historically by schools, departments, and activities. Also available is a historical report of drivers' special trip assignments and refusals. Budgetary billings and outside agency billings are available for any given period, (i.e., daily, weekly, and monthly). A driver copy of the trips, giving departure dates and times, special instructions, and a place for recording actual mileage, time, and expenses can be printed on demand. Year end or season end recaps by activity are available for analysis. The user can define rate codes in any combination of mileage, time, flat rate, or driver rates to determine trip costs.

Hardware Environment: IBM PC/XT/AT and compatibles

General Information: Written in BASIC; can be integrated with BISPAC's 'TIMS' Vehicle Maintenance and Routing Systems; six month guarantee, user training, and telephone support available.

Author/Manufacturer: BISPAC Systems
P.O. Box 580
9256 Madison Ave.
Orangevale, CA 95662

POC: (916) 988-1111

Major Category: Vehicle Operations

Functional Area: Dispatch Operations

Title: Transportation Network Problem Solver (TPR088) Cost: $149

Description: TPR088 is an interactive system for finding routes on transportation networks. Networks can have up to 512 nodes and 16,383 links. Links can be either one-way or bidirectional. TPR088 includes procedures for finding the shortest path between two points on the network, the best sequencing of up to 50 stops, minimum spanning trees, and minimum times and distances between all points. The program includes a menu-driven system for setting up networks and for solving problems. Additional features are a graphics network display, spreadsheet-style input and editing of problems, input from sequential files, storage systems for networks and problems, report generator, output to sequential files, 8087 support, and a sample U.S. interstate road network.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS operating system; requires 192K RAM

General Information: Written in MBASIC; documentation included; 1st installed in 1985; maintenance hotline included

Author/Manufacturer: Eastern Software Products
P.O. Box 15328
Alexandria, VA 22309

POC: (703) 360-7600

Major Category: Vehicle Operations

Functional Area: Equipment Support

Title: Z-248 Maintenance & Inventory Control Program

Cost: Public Domain

Description: This program was written to maintain an equipment inventory and maintenance status listing. It could be used for tracking all micros in an organization. Output is made up of several different user selectable reports.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Last updated November 1987

Author/Manufacturer: Unknown

POC: Dial-A-Log Bulletin Board

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Accident Records Summary (ACCSUM) Cost: $100

Description: ACCSUM is a program which summarizes sets of motor vehicle accident records. Its principal use is in studying the accident history of a particular intersection, midblock section, or length of highway. For a given set of accident records the outputs consist of frequency distributions and percentage distributions of accident type by severity, road surface condition, weather condition, collision type, month of the year, day of the week, hour of the day, and directions of travel by accident type. These summary outputs are available for an entire file of accident records, for a subset of records within a file, for multiple files, and for subsets within multiple files. The inputs required are values for a variety of variables normally found on standardized accident report forms.

Hardware Environment: IBM PC and compatibles

General Information: Written in BASIC

Author/Manufacturer: DK Graphics
8025 State Street Rd
Port Byron, NY 13140

POC: (315) 776-4202

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Auto Fleet Management Cost: Contact Vendor

Description: Auto Fleet Management keeps track of all operating and maintenance costs for each individual vehicle in a fleet. Maintenance and repair reports are by vehicle, vehicle types, or yearly mileage reports. It has the capability to utilize computer tapes supplied by the oil companies, for the inputting of credit card charges made by the drivers.

Hardware Environment: IBM PC/XT/AT and compatibles

General Information: Written in Business BASIC III; documentation included; 1st installed in 1982; customizing available; two days training included; 90 days maintenance

Author/Manufacturer: Spectra Computer Services, Ltd.
Unit 41-1313 Border St
Winnipeg, Manitoba, Canada R3H0X4

POC: (204) 694-2332

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Calendar Ver 2.5 Cost: Public Domain

Description: The calendar program is designed to provide a flexible, interactive method to easily monitor a variety suspense items, activities, and special dates. Calendar will quickly display and/or print monthly calendars, daily events and can provide other information useful to office environments.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Lasted updated January 1987

Author/Manufacturer: Unknown

POC: Dial-A-Log

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Computer Assisted Transportation System (CATS) - Driver's Evaluation

Cost: Public Domain

Description: Automates the recordkeeping and reporting system of the base driver's school. It provides more accurate record keeping and better assessment of driver resources available at the base level.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in BASIC, CONDOR, GRAFTALK, and PEACHTEXT

Author/Manufacturer: AFLMC/LGT
Gunter AFS, AL 36114

POC: AV 446-4464

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Dash 2 Plus

Cost: Public Domain

Description: This program provides users with a convenient way to create and print DD-1387-2 forms which are used to certify hazardous materials for air shipment. In addition, it allows users to store commonly used DD-1387-2 templates and recall them for later use. This program is particularly useful in mobility exercises and contingency situations.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in dBASE II; last updated in October 1986

Author/Manufacturer: AFLMC/LGT

POC: AV 446-4464

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Estimation of Cost and Subsidy Requirements

Cost: Free

Description: This Lotus 1-2-3 template performs the following tasks:

- Estimates operating expenses using the following input data: length of each vehicle trip, number of trips per day, number of days operated per year, total passengers per mile, and operating cost per mile.

- Calculates performance indicators for each improvement and sorts them for priority analysis.

- Compiles summary five-year program tables including number of miles of service, number of passengers, and operating cost

Hardware Environment: IBM XT and compatibles; MS-DOS operating system; requires 512K RAM

General Information: A Lotus 1-2-3 template; not fully documented

Author/Manufacturer: San Diego Metropolitan Transit Board
620 'C' Street, Suite 400
San Diego, CA 92101

POC: (619) 231-1466

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Fleetplan

Cost: Contact Vendor

Description: This is a transport management system that covers internal maintenance, external repairs, fuel distance and vehicle specifications. Workshop Control extends standard Fleetplan to cover campaign/recalls, work outstanding, and service details. Job Costing covers the recharging of jobs and parts to external users with overheads and profit margins. Fleetware covers the hiring and recharging of vehicles and plan to user departments on a daily or weekly basis. It covers vehicle and driver availability.

Hardware Environment: IBM PCs and compatibles; pick operating system;

General Information: Written in Data BASIC; documentation included; 1st installed in 1983; 100 current users; customizing available; one day training included per module

Author/Manufacturer: Fletcher Computer Services, Ltd.
2115 Coventry Rd.
Sheldon, Birmingham, England B263EA

POC: 021-743-8721

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Fuel and Mileage Reporting System  Cost: $850

Description: Produces daily, monthly, and quarterly statistical reports showing breakdown of mileage by state and by vehicle and the fuel consumed by vehicle. The following functions are provided: Vehicle Master File Maintenance, Fueling Terminal File Maintenance, and Mileage and Fuel Usage Data Entry. All programs can be entered via the menu MENUFM and the user is guided through all processing by tutorial prompts. This system is independent of all other applications and its files interface with no other applications.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS operating system; requires 256K RAM

General Information: Written in DMS Cobol; documentation included; 1st installed in 1981; customizing available

Author/Manufacturer: Datamatics Management Services, Inc.
330 New Brunswick Ave.
Fords, NJ 08863

POC: (201) 738-9600

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Service Planning Case Studies Cost: Public Domain

Description: A series of service modifications are analyzed using A) cost allocation and B) a supply versus cost model. Part A takes total system costs in each of several expense categories (direct labor costs, materials and supplies costs, bus hours, bus miles, peak number of buses, weekdays of service), allocates them to three supply variables and computes unit costs for each variable. Part B uses the unit costs computed in Part A to calculate bus requirements and costs by time period.

Hardware Environment: IBM PC and compatible; MS-DOS operating system; requires 192K RAM; uses Lotus 1-2-3

General Information: Very useful for the novice spreadsheet user and as a basis from which to tailor your own custom applications.

Author/Manufacturer: Multisystems, Inc.

POC: TIME Support Center
Department of Civil Engineering
Rensselaer Polytechnic Institute
Troy, NY 12180-3590
(518) 276-6227

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: UTILIFLEET Cost: $295

Description: This system lets users monitor their fleet to keep each vehicle running at maximum efficiency. The system will help users detect operational irregularities. The final result of UTILIFLEET is a cost per mile analysis for each vehicle and a bar-graph comparison of all vehicles. Up to 250 vehicles can be stored per disk and the following information is stored for each vehicle: serial number, year, make, model, odometer reading upon receipt, purchase price, date of receipt, vehicle weight, and operating costs.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system; requires 128K RAM

General Information: Unknown

Author/Manufacturer: Tecnomics Microcomputer Software
100 Ardmore St.
Blacksburg, VA 24060

POC: (800) 368-3532

Major Category: Vehicle Operations

Functional Area: Fleet Management

Title: Vehicle Cost Analyzer Cost: Contact Vendor

Description: Designed to assist fleet managers in purchasing, maintaining, and replacing vehicles in the most economical manner possible. It automates the process of computing the annualized equivalent of life cycle costing. Assists in maintenance policies and replacement decisions. Allows evaluation of many more purchase, maintenance, and replacement options than could be performed manually. Facilitates sensitivity analysis of critical assumptions regarding inflation, the cost of capital, and so forth. Most important, the Cost Analyzer provides a rational economic, systematic, and consistent process for making decisions regarding purchase, maintenance, and replacement that will minimize vehicle cost.

Hardware Environment: IBM PC and compatibles; PC/MS-DOS operating system; requires 128K RAM

General Information: Currently installed in several major utility fleets ranging in size from 200 to 6000 vehicles; requires no computer knowledge; requires on-site installation and user training

Author/Manufacturer: Ernst & Whinney
1225 Connecticut Avenue, N.W.
Washington, D.C. 20036

POC: (202) 862-6013

Major Category: Vehicle Operations

Functional Area: Operations Supervision

Title: BBARN Ver 4 Cost: $295

Description: Generates a detailed architectural space program for any bus fleet from 5 to 350 buses. The space program includes an itemized breakdown for more than 60 elements in the General Offices, Operations, Repair, Vehicle Storage, and Outside Areas. BBARN is useful for:

1. Analyzing the surplus of space in an existing bus garage;

2. Determining the site size required for a new garage;

3. Estimating the staging required to meet future needs;

4. Preparing a space program.

Hardware Environment: IBM PC/XT/AT and compatibles; PC/MS-DOS operating system

General Information: Written in BASIC; documentation included

Author/Manufacturer: New Alternatives, Inc.
8 South Michigan Avenue, Suite 610
Chicago, IL 60603

POC: (312) 263-2808

Major Category: Vehicle Operations

Functional Area: Operations Supervision

Title: Fleetplan Cost: Contact Vendor

Description: This is a transport management system that covers internal maintenance, external repairs, fuel distance and vehicle specifications. Workshop Control extends standard Fleetplan to cover campaign/recalls, work outstanding, and service details. Job Costing covers the recharging of jobs and parts to external users with overheads and profit margins. Fleetware covers the hiring and recharging of vehicles and plan to user departments on a daily or weekly basis. It covers vehicle and driver availability.

Hardware Environment: IBM PCs and compatibles; pick operating system;

General Information: Written in Data BASIC; documentation included; 1st installed in 1983; 100 current users; customizing available; one day training included per module

Author/Manufacturer: Fletcher Computer Services, Ltd.
2115 Coventry Rd.
Sheldon, Birmingham, England B263EA

POC: 021-743-8721

Major Category: Vehicle Operations

Functional Area: Operations Supervision

Title: Operator Performance and Tracking System (OPETS) Cost: Contact Vendor

Description: Enables managers to monitor the performance of up to several hundred drivers and other personnel. Tracked indicators include attendance, accidents, passenger complaints and commendations. OPETS tabulates a series of 15 performance measures for each operator and group of operators. Summary reports compare performance to target levels. The system also generates a personal summary for those employees due to be counseled in the upcoming month.

Hardware Environment: IBM PC/XT/AT and compatibles; PC-DOS and/or UNIX operating system; hard disk required

General Information: Developed using INFORMIX database management system; menu-driven and designed for use by clerical staff with no prior computer training.

Author/Manufacturer: Multisystems, Inc.
1050 Massachusetts Avenue
Cambridge, MA 02138

POC: Senior Transportation Analyst
(617) 864-5810

Major Category: Vehicle Operations

Functional Area: Operations Supervision

Title: PERSONNEL

Cost: Contact Vendor

Description: Enables managers to maintain files for all employees and for recruitment activities, job assignments, and commendations/disciplinary actions. Generates a series of reports that can be used to monitor workforce composition, assignments, pay rates, individual job and benefit status, personnel activity, applicant flow and affirmative action programs.

Hardware Environment: IBM PC/XT/AT and compatibles; PC-DOS and/or UNIX operating system; hard disk required

General Information: Developed using INFORMIX DBMS; menu-driven and designed for people with no prior computer training

Author/Manufacturer: Multisystems, Inc.
1050 Massachusetts Avenue
Cambridge, MA 02138

POC: Senior Transportation Analyst
(617) 864-5810

Major Category: Vehicle Operations

Functional Area: Operations Supervision

Title: Personnel Automated Tracking and Scheduling (PATS)

Cost: Public Domain

Description: PATS is a training scheduling system that was developed to track and schedule personnel through their various training requirements. It schedules on a calendar basis those periodic and one-time training requirements given the proposed class schedule.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in FORTRAN 77

Author/Manufacturer: AFLMC/LGM
Gunter AFS, AL 36114

POC: AV 446-4581

Major Category: Vehicle Operations

Functional Area: Operations Supervision

Title: Transit Route Planning CAI Course  Cost: Free Loan

Description: A 5 to 6 hour course of instruction about principles of route evaluation, route location and ridership estimation. The computer asks questions, evaluates responses, provides tutorial as necessary, and keeps score. The first module, "Route Evaluation," covers basic definitions, operating characteristics of routes, performance indicators, and costs of operation. The second module, "Route Location," covers stop spacing, stop location, running time analysis, route structure, and disutility of travel. The third module, "Ridership Forecasting," explains simple methods of estimating changes in ridership after there has been a change in service. All modulles make extensive use of problems and reinforcement of previously covered material.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Free loan for a period of two weeks to transit systems. planning agencies, departments of transportation, and educational institutions. Specify dates needed.

Author/Manufacturer: Center for Urban Transportation Studies
University of Wisconsin-Milwaukee
P.O. Box 784

POC: (414) 963-5787

Major Category: Vehicle Operations

Functional Area: Vehicle Operations Officer

Title: Automated Mobility Schedule of Events (AMSOE) Cost: Public Domain

Description: Develops the Mobility Schedule of Events (MSOE) timing criteria for processing personnel, cargo marshalling, and chalk loading; based on user specified tasking, processing parameters, and departure method (airlift or ground convoy). Permits changes to existing MSOE as well as monitors activity times during execution. Various screen displays will portray all the activity times concerning deployment actions.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in C; last updated in June 1987

Author/Manufacturer: AFLMC/LGX
Gunter AFS, AL 36114-6693

POC: AV 446-3535

Major Category: Vehicle Operations

Functional Area: Vehicle Operations Officer

Title: Critical Path Program (CPM) Cost: Public Domain

Description: A methodology for determing critical tasks that, if not accomplished by a certain time, contribute directly to the delay of the entire project. Either a file or interactive input is possible. Produces Gantt charts.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in Turbo Pascal

Author/Manufacturer: HQ AFOTEC/SCTC

POC: Dial-A-Log

Major Category: Vehicle Operations

Functional Area: Vehicle Operations Officer

Title: Super Project Plus Cost: $495

Description: A project management package that is designed to allow for greater control over tasks, resources, budgets and scheduling, regardless of industry or computer expertise. This package incorporates PERT, CPM and Gantt charts. Super Project Plus supports a number of tasks, subtasks, milestones and resources. It allows for the creation of 'customized' reports through the use of SuperCalc spreadsheets.

Hardware Environment: IBM PC/XT/AT and compatibles; MS-DOS or PC-DOS operating system; requires 320K RAM

General Information: Written in CBASIC; documentation included; 1st installed in 1984; maintenance available; customizing available

Author/Manufacturer: Computer Associates Micro Products
2195 Fortune Drive
San Jose, CA 95131

POC: (408) 942-1727

Major Category: Vehicle Operations

Functional Area: Vehicle Operations Officer

Title: Suspense Log Program Cost: Public Domain

Description: This system is a menu driven program that allows automatic updating of weekly suspense actions. Reports of pending and completed actions are generated for each action group. There are 3 versions of the program included in this library; one for dBASE II, one for dBASE III and a compiled version.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Last updated September 1984

Author/Manufacturer: SSC/SSMCS
Gunter AFS, AL 36114

POC: AV 446-4571

Major Category: Vehicle Operations

Functional Area: Vehicle Operations Officer

Title: TDY Tracker

Cost: Public Domain

Description: Maintains a database of TDY costs and prints a report from the data.

Hardware Environment: IBM PC and compatibles; MS-DOS operating system

General Information: Written in dBASE II

Author/Manufacturer: Unknown

POC: SSC/PRRCC
Gunter AFS, AL 36114
AV 446-4571

## ALPHABETICAL INDEX


1. Accident Records Summary - FM
2. Automated Mobility Schedule of Events (AMSOE) - VOO
3. Auto Fleet Management - FM
4. Automated DD Form 173 - A&T
5. BBARN ver 4.0 - OS
6. Calendar ver 2.5 - FM
7. CATS - FM
8. CFAVMRS: Fleet Maintenance Management System - MC&A
9. Critical Path Program - VOO; VMM
10. Dash 2 Plus - FM
11. Estimation of Cost and Subsidy Requirements - VM
12. Fleet Care Software - MC&A
13. Fleet Maintenance System - MC&A
14. FLEET*MATE - MC&A; MC
15. Fleetplan - FM; OS
16. FORMS - A&T
17. Fuel and Mileage Reporting System - FM
18. LANTA Parts Inventory Package - MC
19. Materials Management - MC
20. OnTime - MC&A
21. Operator Performance and Tracking System (OPETS) - OS
22. PERSONNEL - OS
23. Personnel Automated Tracking and Scheduling (PATS) - A&T; OS
24. Ridership Analysis System - DO

25. Roadsearch Plus - DO

26. Service Monitoring Package (SMP) - DO

27. Service Planning Case Studies - FM

28. Special Trips and Reservation - DO

29. Super Project Plus - VOO; VMM

30. Suspense Log Program - VOO; VMM

31. TDY Tracker - VOO; VMM

32. Transit Route Planning - DS

33. Transportation Information Management System (TIMS) - MC&A

34. Transportation Network Problem Solver (TPR088) - DO

35. Typing Messages Using WORDSTAR - A&T

36. Unit Administration Management System - A&T

37. UTILIFLEET - MC&A; FM

38. Vehicle Cost Analyzer - FM

39. Vehicle Manager - MC&A; MC

40. WORDSTAR Form Templates - A&T

41. Z-248 Maintenance and Inventory Control Program - ES

KEY

VOO - Vehicle Operations Officer
OS - Operations Supervision
DO - Dispatch Operations
ES - Equipment Support
FM - Fleet Management
VMM - Vehicle Maintenance Management
A&T - Administration and Training
MC&A - Maintenance Control and Analysis
MC - Materiel Control

## APPENDIX III

## Transportation Bulletin Board Systems

### PC-TRANSport

The PC-TRANSport electronic bulletin board is operated as one of the services of the PC-TRANS microcomputing resource and information center at the University of Kansas. It includes a variety of software packages of transportation and general interest, the latest edition of the PC-TRANSmission newsletter in electronic form, bulletins on various subjects, and message transfer among users and between users and staff. Although anyone can log on, the primary purpose of PC-TRANSport is to enhance the services available to PCTRANS subscribers and to foster information exchange; therefore, downloading and uploading of files can only be performed by PC-TRANS subscribers.

To log on to PC-TRANSport, dial (913) 864-5058, using 8 data bits, 1 stop bit, no parity, and either 300 or 1200 baud. For more information, contact Carl Thor, (913) 864-5655.

### INFOTAP

The Institute for Transportation Studies at the University of California at Berkeley has developed an electronic bulletin board system that is available to transportation and public works professionals across California.

The electronic bulletin board, accessible to any profes sional or agency equipped with a terminal or microcomputer and a modem, has been created to support information exchange and integration within the State's transportation and public works community.

The INFOTAP electronic bulletin board is designed to provide the following services:

- software library with current transportation, public works, and general software that can be downloaded;
- current listing of conferences, courses, seminars, and other events of interest;
- current listings of microcomputer support services, including user groups and software catalogs;
- bulletin system, where professionals may electronically post or read public notices from other professionals;
- electronic message system, where users may send and read mail to or from another user or groups of users;
- direct electronic contact to Tech Transfer facilities, where on-line communication and consultation can be transacted.

The INFOTAP electronic bulletin board is in full service operation 24 hours a day. The phone number for electronic connection through a modem to INFOTAP is (415) 642-7088. INFOTAP will automatically connect at either 300 or 1200 baud. There is no charge for use of INFOTAP or any of its functions, including the downloading of software programs. Users will, however, be restricted to one hour of

use per session. For more information, call Christine Lorenz (Systems Operator) at (415) 642-1008.

## Glossary

1. Application Program - software that supports a specific end-user activity

2. Categorical Relationship - a relationship between entities that corresponds to a single real-world concept

3. Conceptual Schema - an integrated, logical data model of a given data resource, independent of the biases of particular users or applications and neutral to physical implementation structures; represents knowledge of shareable data that can be changed to reflect modifications in the use of the data

4. Data - a representation of facts, values and concepts, along with their meanings, in a formalized manner suitable for communication, interpretation, or processing by humans or machines

5. Data Accessibility - the capability for a user to extract needed information from a database

6. Data Administrators(DA) - a person or organization responsible for logical database design, development of user documentation materials, building and maintaining a data dictionary system, establishing data naming standards, and controlling and managing the data resource

7. Database - a collection of logically related data that supports shared access by many users and is protected and managed to retain its value

8. Database Administrator(DbA) - a person or organization responsible for physical database design, evaluation of database performance, and reorganization of the database as needed to maintain satisfactory performance

9. Data Asset - that raw material which is able to be processed to produce usable information

10. Data Driven - describes a systems development methodology emphasizing management of data as resources and building data assets

11. Data Element - a unit of data which is not decomposable into other individually named units

12. Data Field - a named characteristic or descriptor of an entity

13. Data Integrity - the completeness and consistency of a database

14. Data Resource - data which has been processed into information which possesses inherent value

15. Data Security - the ability to prevent unauthorized accesses to and actions on a database

16. Data Shareability - the capability for many users to access the same database's contents and logic

17. Direct Access - the ability to access any of a collection of records without having to access the physically preceding records

18. Effectiveness - a measure of how well a system meets users' needs

19. Efficiency - a measure of the utilization of physical resources

20. Lifecycle - the sequence of stages in a system's creation, growth, and retirement

21. Logical Database - the entities, attributes, and relationships within a specified scope, represented independently of how the data and relationships are structured and stored on physical media

22. Logical Structure - an independent representation of entities, attributes and relationships within some scope of interest that facilitates an understanding about the data represented so that it can be selectively and efficiently accessed

23. Major Installation - an installation at which full-time flying or missile operations are conducted either by a permanently assigned squadron, its equivalent, or higher Active or Reserve Air Force Units; or one at which flying or missile operations are not conducted, but which does have assigned to it a wing headquarters, its equivalent, or a higher level Air Force organization. (Air Force SUMMARY, 1988:F-11)

24. Schema - a diagram, plan, or scheme describing the semantic or representative structure of data

25. Software - the instructions which tell a computer what actions to take

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VITA

Lieutenant John W. Stein [redacted] in 1975 [redacted] enlisted in the United States Air Force following graduation. He completed Administration Specialist School at Keesler AFB, Mississippi in October 1975 and was assigned to several administrative functions at Eielson AFB, Alaska, and F.E. Warren AFB, Wyoming. Upon his honorable discharge in June 1975, he enrolled at Harding College, Searcy, Arkansas as a Biology major. While working part-time and attending school full time, he completed the four year pre-med program in three and one half years. After not being successfully admitted to medical school, he re-entered the Air Force in June 1984 and graduated from Officer Training School in September. Upon completion of Transportation Officer School at Sheppard AFB, Texas in December 1984, he was assigned to the 436th Military Airlift Wing, Dover AFB, Deleware as the Vehicle Operations Officer. In June 1986, he was reassigned as the Vehicle Maintenance Officer, where he served until his acceptance to the Air Force Institute of Technology in May 1987. His awards include the Air Force Good Conduct Medal, the Air Force Achievement Medal, and the Air Force Commendation Medal.

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The conditions and events which served to highlight the fact that *End User Computing (EUC) had been ignored in* the past and is being poorly managed in the present are discussed. Mind-sets and faulty prioritizations which may prevent the successful implementation of software management are also discussed. The significance of implementing a Transportation Software Catalog to enhance the Air Force's computer resources, its role as a significant contribution to effectively managing ground transportation operations, and its potential for improved savings are addressed as well. The timing of EUC management emphasis and of trade-offs, current guidance and direction, recommended methods of implementation, and current examples of off-the-shelf transportation software available from both military and civilian sources have also been investigated.